

NATIONALGEOGRAPHIC.COM/MAGAZINE | JULY 2008

WHY THE  
WEST IS  
BURNING

# NATIONAL GEOGRAPHIC

**WHO MURDERED  
THE MOUNTAIN GORILLAS?**



2

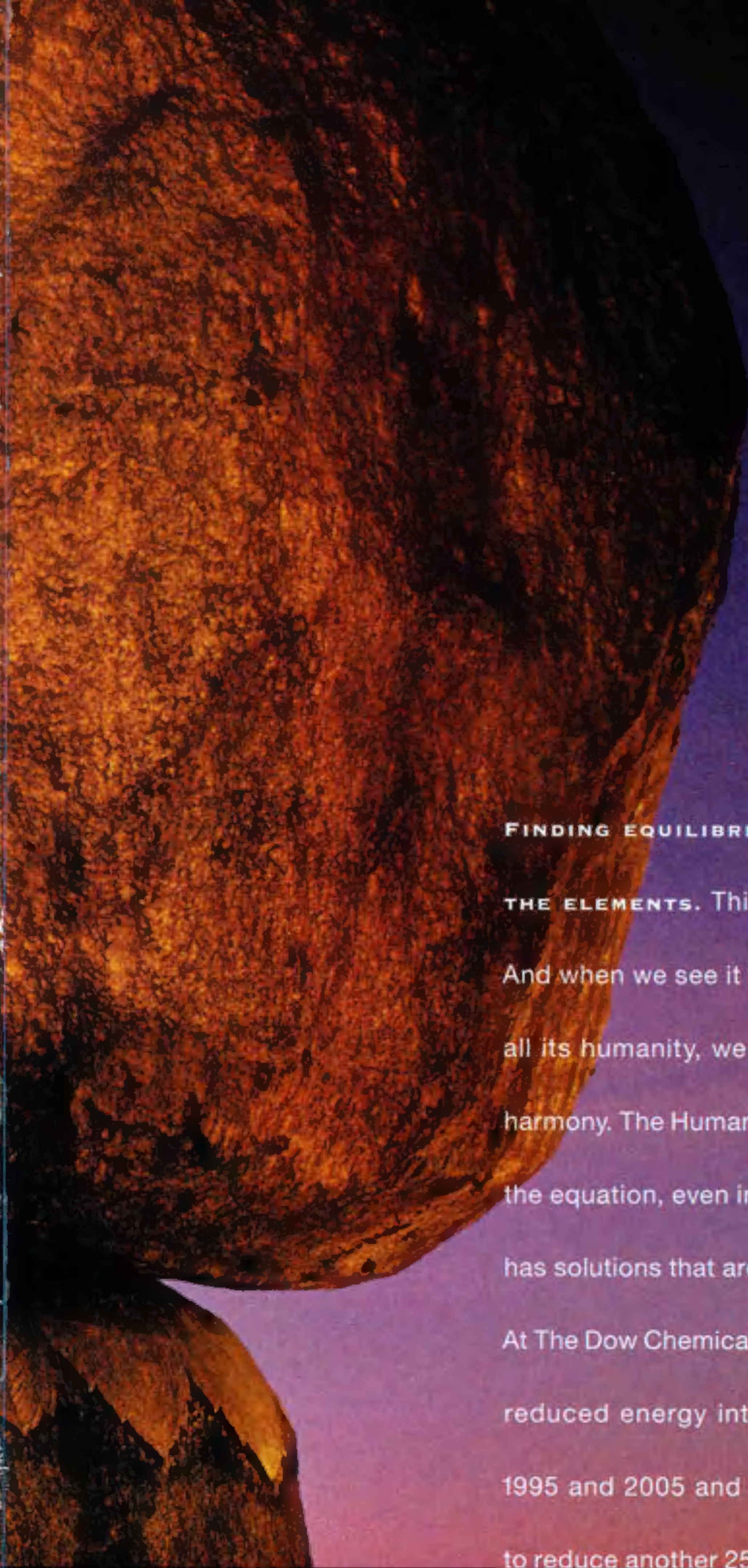
Hu

HUMAN

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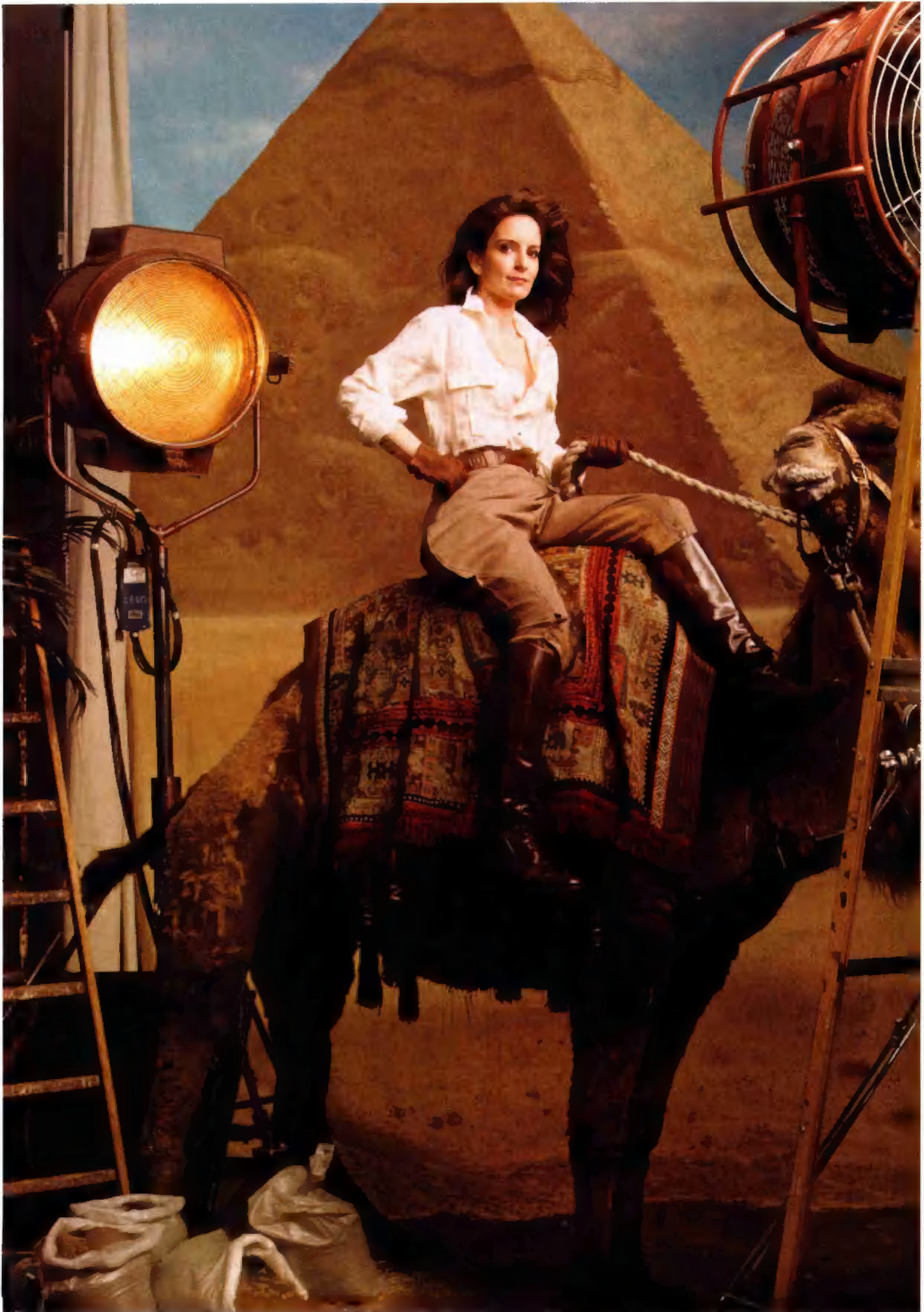


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Cardmember ..... Tina Fey .....

Member Since ..... 2000 .....

Occupation ..... writer/performer .....

Recent trip ..... New York to Ohio for a family reunion .....

Favorite moment ..... sitting out in the yard at night, listening to stories .....

Most interesting souvenir ..... an Amish baby doll with no face .....

Favorite travel outfit ..... Red leather suits. Always. ....

In-flight movie ..... I once cried a little bit at a romantic movie with Hugh Grant and Sandra Bullock... Some might say it was the altitude, but I beg to differ .....

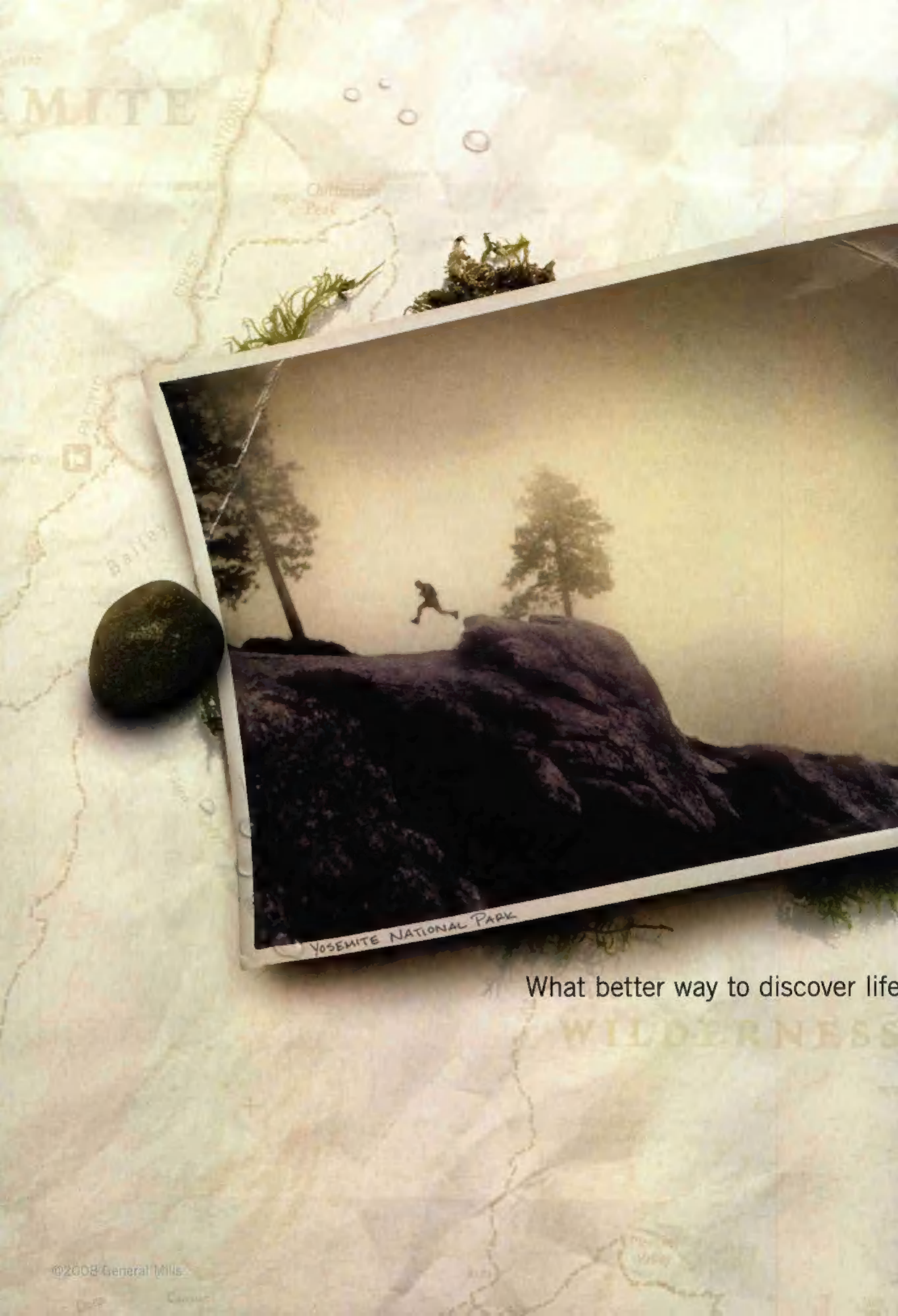
Travel wish ..... I would like to be crated and sedated like a dog. ....

My card ..... gets me in the airport lounge with the free cheese and crackers. ....

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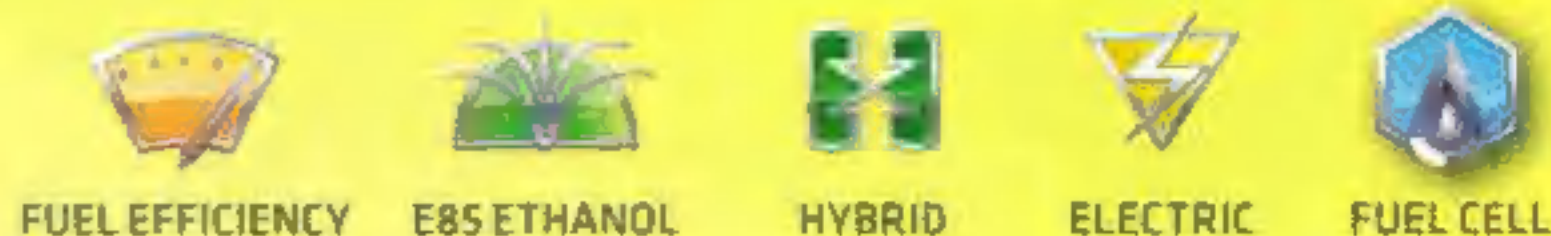


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on a map.

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**2009 Chevy Aveo5 2LT with available 15" 5-spoke aluminum wheels shown. Preproduction model shown. Actual production model may vary. Available summer 2008.**

<sup>1</sup>Based on EPA estimates and segmentation. <sup>2</sup>Based on 2008 GM Compact Car 3-Door Coupe segment. <sup>3</sup>Very limited availability. <sup>4</sup>Based on GM estimates. Official EPA estimates not yet available. <sup>5</sup>2008 Silverado 2WD with available 5.3L engine has EPA est. MPG 15 city/20 hwy. <sup>6</sup>Based on 2008 GM Large Utility segment and 2008 EPA estimates. Tahoe 2WD with available 5.3L V8 has EPA est. MPG 14 city/20 hwy. Excludes other GM vehicles. <sup>7</sup>Source: fueleconomy.gov. ©2008 GM Corp. Buckle up, America!



# NATIONAL GEOGRAPHIC

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- Virunga Gorillas** **34** Murder haunts Africa's oldest park.  
*By Mark Jenkins Photographs by Brent Stirton*
- The Altiplano** **66** "Otherworldly" is the word for Bolivia's sky-high plain.  
*By Alma Guillermoprieto Photographs by George Steinmetz*
- Bolivia's New Order** **88** The country's indigenous people assert their power.  
*By Alma Guillermoprieto Photographs by George Steinmetz*
- Tyrannosaur Trap** **104** An ancient death struggle tells its story in stone.  
*By Peter Gwin Photographs by Ira Block*
- Under Fire** **116** Flames threaten the American West. Again.  
*By Neil Shea Photographs by Mark Thiessen*
- Kingman Reef** **144** Is this our last, best look at what a coral reef should be?  
*By Kennedy Warne Photographs by Brian Skerry*



Plumes and platforms adorn dancers in Oruro, Bolivia. The town's Carnival is the country's biggest cultural event. Story on page 88.

GEORGE STEINMETZ

How do *you* sleep?



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When Mom was my age, there weren't many ways to prepare financially for what was coming. You just had to work hard, save what you could and hope for the best. So here I am, taking care of my mom and my kids at the same time. I've never worked so hard, or stretched a dollar so far.

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Reopening the Romanov Case



Spotlight on Giraffe Spots



The Line on Subways

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**On the Cover**

A silverback mountain gorilla confronts life in a war zone in the Democratic Republic of the Congo. *Photo by Brent Stirton*

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## EDITOR'S NOTE

**“The only thing** that stopped the Tillamook fire was the Pacific Ocean,” my grandfather said. He wasn't far off the mark. That 1933 forest fire, one of Oregon's biggest, was never contained. The firestorm uprooted huge Douglas firs. Cinders rained on ships 500 miles out at sea. The fire scorched 240,000 acres before rain extinguished it. Some 3,000 men fought the blaze. My grandfather was one of them.

I grew up in the forest fire country of southern Oregon. My father and I would drive to the Medford Air Tanker Base



Doused with fire retardant, a fireman fights on.

to watch B-17s lumber down the runway loaded with a slurry of fire retardant to smother flames. We'd hear about mechanics picking pinecones out of engine cowlings because the bombers flew so low they'd slice the tops off trees.

This knowledge was useful when photographing a fire in Oregon in 1979

for my first *Geographic* assignment. When bombers flew overhead, my instinct was to run for cover, until I remembered the knocked-off treetops and headed for a clearing. It was better to be pelted by slurry than crushed by a tree.

In October 1899 this magazine published “The Relation of Forests and Forest Fires,” by Gifford Pinchot, first director of the U.S. Forest Service. Pinchot's “snuff them” approach to wildfires has since evolved. As photographer Mark Thiessen and writer Neil Shea report, we now know that fire is an ecological necessity. If our understanding has changed, one thing has not: Forest fires still fill us with awe.

A handwritten signature in black ink, appearing to read "Chris Jones". The signature is fluid and cursive, with a horizontal line underlining the name.

### PEOPLE BEHIND THE STORIES

#### ■ Alma Guillermoprieto

A reporter whose beat was “the world of people, not nature,” who didn't have “even slightly



mystical inclinations,” experienced an epiphany in Bolivia, where she was writing two articles

for this issue. In the remote salt flats of the Uyuni region, Guillermoprieto says, “I was overwhelmed by the immensity of the landscape. Later I traveled along the shore of Lake Titicaca, which seemed to me as deep and blue as the eye of heaven. I thought I knew Bolivia, but those two trips gave me an insight into the native peoples—the lost grandeur that seems to haunt them, their intense religious life—that I couldn't have gotten in a month of interviews.”

■ Neil Shea Years ago Shea fought forest fires in Massachusetts. Now a *Geographic* staff writer, he recalls the danger that came from the



flames—and from what was fleeing them. “Sometimes rattlesnakes and copperheads would

slither past your feet,” he says. For this issue's “Under Fire,” Shea spent a month reporting in Idaho, Montana, and Wyoming. He says western fire crews have more to worry about than their eastern counterparts. “They're always watching out for boulders bouncing down hillsides, collapsing trees, bears, mountain lions. Flames are just one part of it.”



**Allen Cays Iguana** (*Cyclura cychlura inornata*)

**Size:** Head and body length, 26.5 - 46 cm (10.4 - 18.1 inches); tail, 34.5 - 59.8cm (13.5 - 23.5 inches)

**Weight:** 0.5 - 5 kg (1.1 - 11 lbs)

**Habitat:** Northern Exuma Island chain, Bahamas; prefers areas of tropical dry forest, coastal coppice and beach strand vegetation

**Surviving number:** Estimated at fewer than 1,000

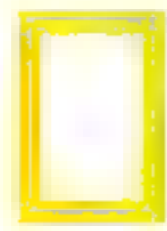
Photographed by Solvin Zankl

# WILDLIFE AS CANON SEES IT

Claim a nest, get no rest. The female Allen Cays iguana needs lots of energy to bring the next generation into the world, which is why she takes longer than any other lizard to reach sexual maturity — at least 12 years. She defends her nesting site with head bobs, charges and face-offs with other iguanas. Then she digs a nesting chamber, lays her eggs, and partially buries them. Hatchlings dig themselves out 80 to 85 days later. Those that survive

become some of the largest — and most endangered — lizards in the world. Constrained by its habitat and harried by human interference, including capture for the pet trade, the iguana can hardly rest easy.

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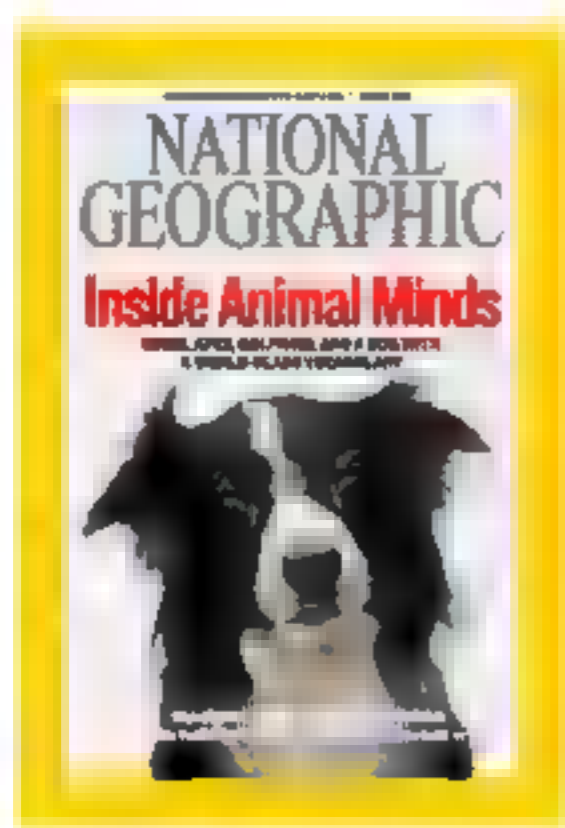


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[americanchemistry.com/reuse/essential](http://americanchemistry.com/reuse/essential)



**March 2008** *No pets wrote in about "Minds of Their Own," but they didn't need to. Scores of their owners attested to animal smarts. Dorothy Tarantino of Huntington, New York, had a dog that would fetch its snowman toy each Christmas. Drew Hiram Lynch's mynah called neighbors by name. "Humans are the slow learners," wrote Lynch, of Hurt, Virginia. "But we are improving."*

➔ Comment on July stories at [ngm.com](http://ngm.com).

## Minds of Their Own

As a physical scientist, I was pleased to read that the pendulum has slowly swung away from the animal-as-machine model and back toward Darwin's theories of animal intelligence. As a dog lover, I was excited to read of Rico the border collie. My springer spaniel has outsmarted both me and the wily pheasant in the grass, scenting the bird, checking the wind, sizing up the situation, and literally backing away from the bird to better guarantee success upon flush.

**LARRY WERNLE**  
O'Fallon, Illinois

How incredibly sad. Irene Pepperberg spends 30 years trying to communicate with Alex, an African gray parrot, so she can ask "how he sees the world." When she succeeds and hears "Wanna go tree,"

## Write, Email, Fax

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Washington, DC 20090-8199

### Email

[ngsforum@nationalgeographic.com](mailto:ngsforum@nationalgeographic.com)

### Fax

202-828-5460  
Include name, address, and daytime telephone. Letters may be edited for clarity and length.

she denies what appears to be a plea for freedom. We need to find a way to study these amazing animals and allow them to live the lives that nature intended.

**MAGGIE RACZEK**  
Portland, Oregon

Of all the animals you could have chosen for the cover story about animal minds, you chose a dog. Why not a dolphin, ape, or raven? Dogs are so overdone—and they're also destructive and noisy.

**LESLIE WHITE**  
Tacoma, Washington

Have researchers asked if animals can grasp philosophical concepts? Last year I stayed in a place in Mongolia where two lambs were tied up near a stairway. I went over to pet them. One looked at me with an expression I can only describe as abject terror. The next time I saw them, they were being butchered. Did these lambs know they were going to be killed? Judging by the looks they gave me, I would have to say they did.

**ED HEALY**  
San Francisco, California

I swear my golden retriever Chaucer said "hi" to me one morning. I had no witnesses but didn't need any. When a

dog looks at you with love in its eyes and whispers, "Hi," it is the sweetest sound imaginable. I've never doubted that animals have more intelligence than some people. Once animals learn to use the computer, we will all be convinced.

**JOYCE WEISS**  
Wynnewood, Pennsylvania

Five years ago my husband and I got a Senegal parrot for a pet. During the time my husband was working late, he would call 10 to 20 minutes before coming home. Sherbert figured out the phone call meant my husband would walk in the door soon and would sit on the piece of furniture nearest the door waiting for him.

**BETTY DUKE**  
Torrance, California

"Why do the cats live in the barn, but the dog is allowed in the house?" I asked my brother the farmer last year. He said it is important for the dogs to live in the house so that they learn English. I laughed. His response was, "Of course they learn English. That's how they follow instructions." I was still incredulous. Then I read about Betsy the border collie and her vocabulary of 340 words. My brother gets the last laugh.

**JOEL SPRENGER**  
Mississauga, Ontario

Dogs don't actually know the meaning of words. A vocabulary is all the words in a language that a person uses. Dogs do not, I repeat, do not, use words. The associations that dogs make with our words is not the same as having a vocabulary.

**APRIL PEDERSEN**  
Reno, Nevada

# Emergency

If you've been here before,  
PLAVIX could help keep you from coming back.

**PLAVIX can help save lives for those who've had a heart attack caused by a completely blocked artery.**



Clots that block off arteries are the main cause of heart attack. And now that you've had a heart attack you are at a greater risk of having another that can be fatal. That's why your doctor may put you on PLAVIX along with your

other heart medicines. Taking PLAVIX with your other heart medicines goes beyond what other heart medicines alone can do to keep blood platelets from sticking together and forming dangerous clots.



**IMPORTANT INFORMATION:** If you have a stomach ulcer or other condition that causes bleeding, you should not use PLAVIX. When taking PLAVIX alone or with some other medicines including aspirin, the risk of bleeding may increase so tell your doctor before planning surgery. And, always talk to your doctor before taking aspirin or other medicines with PLAVIX, especially if you've had a stroke. If you develop fever, unexplained weakness or confusion, tell your doctor promptly as these may be signs of a rare but potentially life-threatening condition called TTP, which has been reported rarely, sometimes in less than 2 weeks after starting therapy. Other rare but serious side effects may occur.

**Ask your doctor how PLAVIX can help increase your protection against future heart attack, stroke, and even death.** Or visit [www.plavix.com](http://www.plavix.com) or call 1-888-289-7169.

See important product information on the following page.

You are encouraged to report negative side effects of prescription drugs to the FDA. Visit [www.fda.gov/medwatch](http://www.fda.gov/medwatch), or call 1-800-FDA-1088.

If you need help paying for prescription medicines, you may be eligible for assistance. Call 1-888-4PPA-NOW (1-888-477-2669), or go to [www.pparx.org](http://www.pparx.org)



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### WHO IS PLAVIX FOR?

PLAVIX is a prescription-only medicine that helps keep blood platelets from sticking together and forming clots.

PLAVIX is for patients who have:

- had a recent heart attack.
- had a recent stroke.
- poor circulation in their legs (Peripheral Artery Disease).

PLAVIX in combination with aspirin is for patients hospitalized with:

- heart-related chest pain (unstable angina).
- heart attack.

Doctors may refer to these conditions as ACS (Acute Coronary Syndrome).

Clots can become dangerous when they form inside your arteries. These clots form when blood platelets stick together, forming a blockage within your arteries, restricting blood flow to your heart or brain, causing a heart attack or stroke.

### WHO SHOULD NOT TAKE PLAVIX?

You should NOT take PLAVIX if you:

- are allergic to clopidogrel (the active ingredient in PLAVIX).
- have a stomach ulcer
- have another condition that causes bleeding.
- are pregnant or may become pregnant.
- are breast feeding.

### WHAT SHOULD I TELL MY DOCTOR BEFORE TAKING PLAVIX?

Before taking PLAVIX, tell your doctor if you're pregnant or are breast feeding or have any of the following:

- gastrointestinal ulcer
- stomach ulcer(s)
- liver problems
- kidney problems
- a history of bleeding conditions

### WHAT IMPORTANT INFORMATION SHOULD I KNOW ABOUT PLAVIX?

**TTP:** A very serious blood condition called TTP (Thrombotic Thrombocytopenic Purpura) has been rarely reported in people taking PLAVIX. TTP is a potentially life-threatening condition that involves low blood platelet and red blood cell levels, and requires urgent referral to a specialist for prompt treatment once a diagnosis is suspected. Warning signs of TTP may include fever, unexplained confusion or weakness (due to a low blood count, what doctors call anemia). To make an accurate diagnosis, your doctor will need to order blood tests. TTP has been reported rarely, sometimes in less than 2 weeks after starting therapy.

**Gastrointestinal Bleeding:** There is a potential risk of gastrointestinal (stomach and intestine) bleeding when taking PLAVIX. PLAVIX should be used with caution in patients who have lesions that may bleed (such as ulcers), along with patients who take drugs that cause such lesions.

**Bleeding:** You may bleed more easily and it may take you longer than usual to stop bleeding when you take PLAVIX alone or in combination with aspirin. Report any unusual bleeding to your doctor.

**Geriatrics:** When taking aspirin with PLAVIX the risk of serious bleeding increases with age in patients 65 and over.

**Stroke Patients:** If you have had a recent TIA (also known as a mini-stroke) or stroke taking aspirin with PLAVIX has not been shown to be more effective than taking PLAVIX alone, but taking aspirin with PLAVIX has been shown to increase the risk of bleeding compared to taking PLAVIX alone.

**Surgery:** Inform doctors and dentists well in advance of any surgery that you are taking PLAVIX so they can help you decide whether or not to discontinue your PLAVIX treatment prior to surgery.

### WHAT SHOULD I KNOW ABOUT TAKING OTHER MEDICINES WITH PLAVIX?

You should only take aspirin with PLAVIX when directed to do so by your doctor. Certain other medicines should not be taken with PLAVIX. Be sure to tell your doctor about all of your current medications, especially if you are taking the following:

- aspirin
- nonsteroidal anti-inflammatory drugs (NSAIDs)
- warfarin
- heparin

Be sure to tell your doctor if you are taking PLAVIX before starting any new medication.

### WHAT ARE THE COMMON SIDE EFFECTS OF PLAVIX?

The most common side effects of PLAVIX include gastrointestinal events (bleeding, abdominal pain, indigestion, diarrhea, and nausea) and rash. This is not a complete list of side effects associated with PLAVIX. Ask your doctor or pharmacist for a complete list.

### HOW SHOULD I TAKE PLAVIX?

Only take PLAVIX exactly as prescribed by your doctor. Do not change your dose or stop taking PLAVIX without talking to your doctor first.

PLAVIX should be taken around the same time every day, and it can be taken with or without food. If you miss a day, do not double up on your medication. Just continue your usual dose. If you have any questions about taking your medications, please consult your doctor.

### OVERDOSAGE

As with any prescription medicine, it is possible to overdose on PLAVIX. If you think you may have overdosed, immediately call your doctor or Poison Control Center, or go to the nearest emergency room.

### FOR MORE INFORMATION

For more information on PLAVIX, call 1-800-633-1610 or visit [www.PLAVIX.com](http://www.PLAVIX.com). Neither of these resources, nor the information contained here, can take the place of talking to your doctor. Only your doctor knows the specifics of your condition and how PLAVIX fits into your overall therapy. It is therefore important to maintain an ongoing dialogue with your doctor concerning your condition and your treatment.

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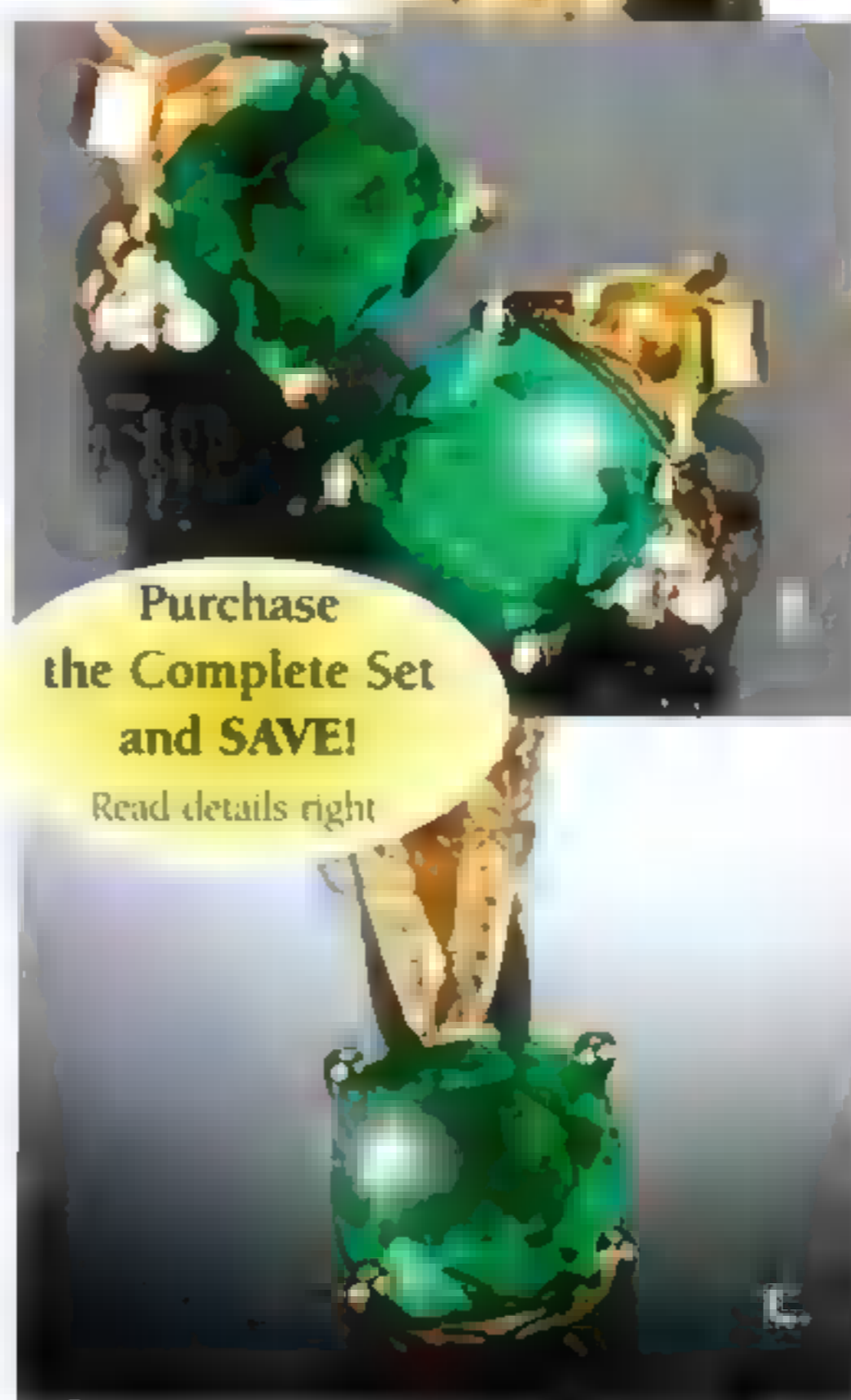
The Queen of all precious gemstones. They have adorned the Crown Jewels and decorated the ornate royal thrones of dynasties dating back 3,000 years. As a symbol of opulence and romance they are without match. With their sparkling green luster, they are considered to be more precious than diamonds. And, carat for carat, they are the most expensive gems in the world. Ever since they were first found in Cleopatra’s Mines and became the foundation of ancient Egypt’s wealth, radiant, deep green emeralds of over 2 carats have been highly prized for their beauty and rarity.

**Greener Green.** But mining these stones is a dirty business. Stauer has found a better way. Our scientifically grown Emerald Collection originates from the intelligence of mankind rather than digging deep into the earth’s surface. The win-win result is a high-carat emerald that’s literally and figuratively green—flashing more color, clarity, and fire than emeralds from a mine but without the environmental damage, labor exploitation, and conflict sometimes associated with gemstone mining. And our scientifically grown emeralds are much more sensibly priced. Even trained gemologists have trouble separating the mined stones from the scientifically grown emeralds because their chemical composition is identical and optical and physical properties are so similar.

**Clearly a desirable alternative!** Being prone to inclusions by the very nature of their turbulent formation beneath the earth, a flawless mined emerald of 2.5 carats and good color is extremely expensive—costing potentially \$40,000 or more. Our earth-friendly, scientifically grown emeralds are faultless



Set in gold vermeil with clear scientifically-grown DiamondAura accents and granulation.



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and inclusion-free, enabling us to create pieces over 2 carats that radiate with rich, vibrant color but costing a lot less of your green!

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**Rare Jewelry from Science.** This scientific process is quite

complicated and calls for some very expensive lab equipment. We use a method called hydrothermal flux synthesis. This technique involves building the emerald crystal with high temperatures and pressures, with final crystallization occurring in a cooling chamber. This process is slow and expensive, so there is a limit to this production. We will make less than half of 1% of the mined carat count for emeralds this year.

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# LETTERS

## Power Struggle

Your article on Iceland's environmental-economic dilemma struck a prophetic note. The population has outgrown most of its resources and now faces a difficult choice: either move on to where resources are plentiful or destroy Iceland's environment trying to harness the last of its resources. It sounds almost like a plot for apocalyptic science fiction.

**NICHOLAS LYLE**  
Burlington, New Jersey

If those opposed to building smelters in Iceland truly wanted to stop such projects, more would have taken advantage of their extraordinarily representative parliament and written letters to their representatives.

**GEO L. NIKOLOV**  
Poolesville, Maryland

As Icelanders are so well educated and creative, I question the urgency in establishing an industry that can be considered both outdated and economically and environmentally unpredictable. I would urge them to set up nanotechnology facilities, banking outposts, and other options.

**ABBY LEY**  
Philadelphia, Pennsylvania

What Icelanders should be wary of are the scars that industrialization projects leave. They are hard to erase, and they almost universally tend to expand rather than contract. Forget hydroelectric.

**DANIEL PANKRATZ**  
Huntington Beach, California

Your article on Iceland asks, "How about some high-end,

eco-conscious tourism on a par with, say, the Galápagos Islands?" The Galápagos are on the Equator. Iceland is 65° north latitude. Next question?

**JOHN ROGERS**  
Wilmington, Delaware

It took an army of curious scientists 16 years and undisclosed millions to think up an experiment they are totally in the fog about, while Isaac Newton needed only a single apple to discover the law of gravity.

## At the Heart of All Matter

As a former particle physicist, I enjoyed your article on the Large Hadron Collider (LHC). Besides the fundamental questions that the LHC may answer, such collaborations prove that good science can be done by people of any race, gender, nationality, or religion. As you point out, although irrelevant in the big picture, it is disturbing that U.S. support for such basic science has withered. I left particle physics, and later the U.S., because of the difficulty I had finding stable employment and research funding. Many of my classmates and I now live and work outside the U.S. We enjoy better research opportunities in countries where society respects and supports science.

**JAMES B. COLE**  
Tsukuba, Japan

It confounds me that scientific priorities can produce a goliath superdetector looking for the universe's smallest particle while refusing to create large-scale, nondestructive energy sources. I wonder what this monstrosity's carbon footprint is, and is it really worth it?

**MATTHEW MARCHESANI**  
Smethport, Pennsylvania

Something is missing regarding the construction of the Large Hadron Collider: benefit. Unlike flush toilets, iPods, ATVs, and cell phones that do everything but brush your teeth, the LHC does not appear to offer one practical benefit for mankind. Oddly, it took an army of curious scientists 16 years and undisclosed millions of dollars to think up an experiment they are totally in the fog about, while Isaac Newton needed only a single apple to discover the law of gravity.

**GEORGE M. KEHEW**  
La Verkin, Utah

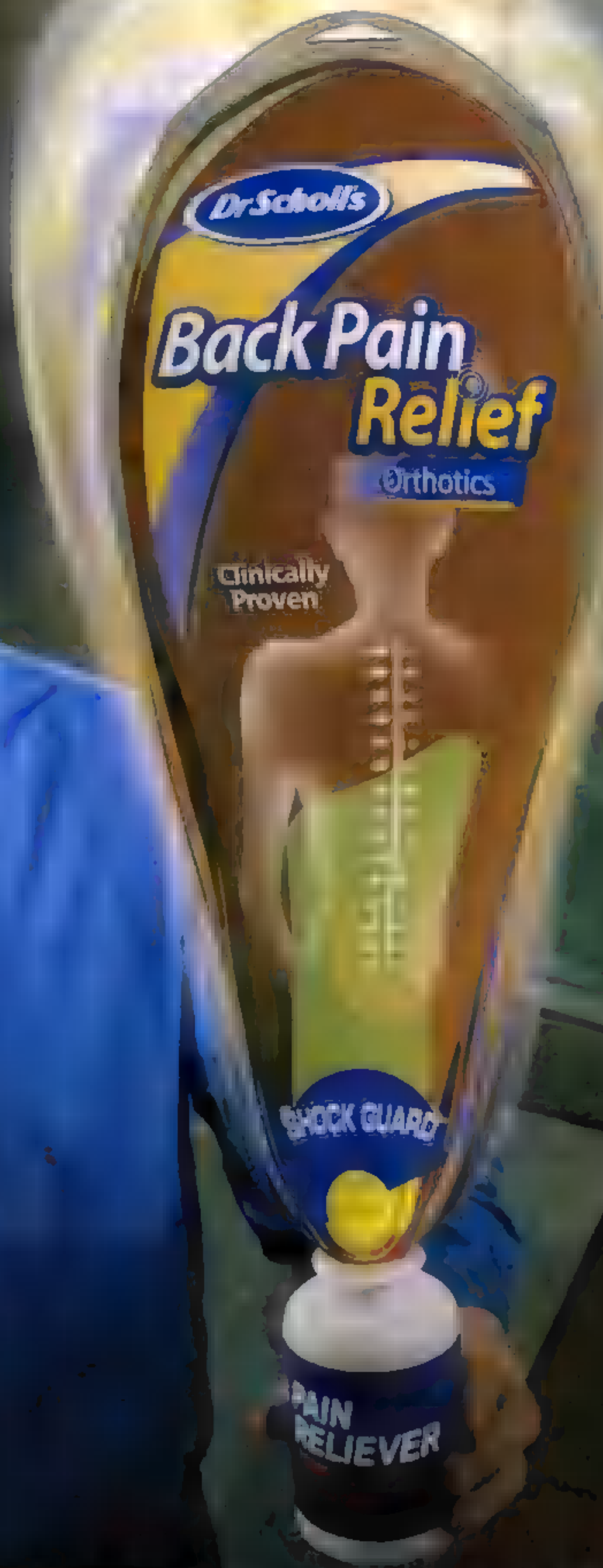
I hope the new atom smasher isn't going to create a new big bang. That would be the God particle's revenge on the human race for discovering it.

**STEPHEN CONN**  
Nelson, New Zealand

## Bhutan's Experiment

What a sad commentary: The violence and misogyny of American gang culture has been successfully marketed, presumably through TV and the Internet, to the youth of Bhutan, one of the most isolated nations. One wonders how this will mesh with their traditional Buddhist faith.

**BILL GOLDEN**  
Asheville, North Carolina



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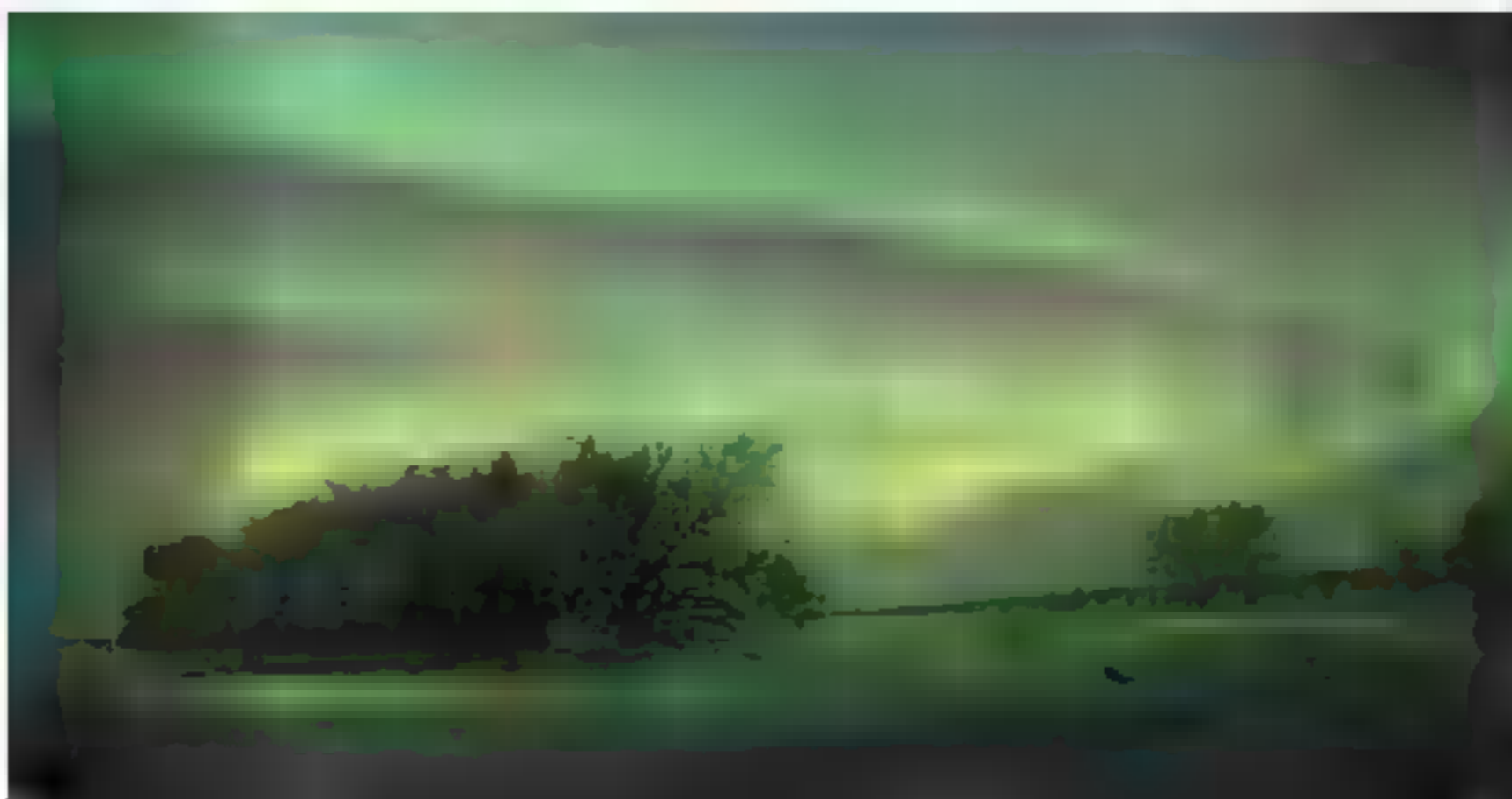


**Elmar Rubio** Swindon, England

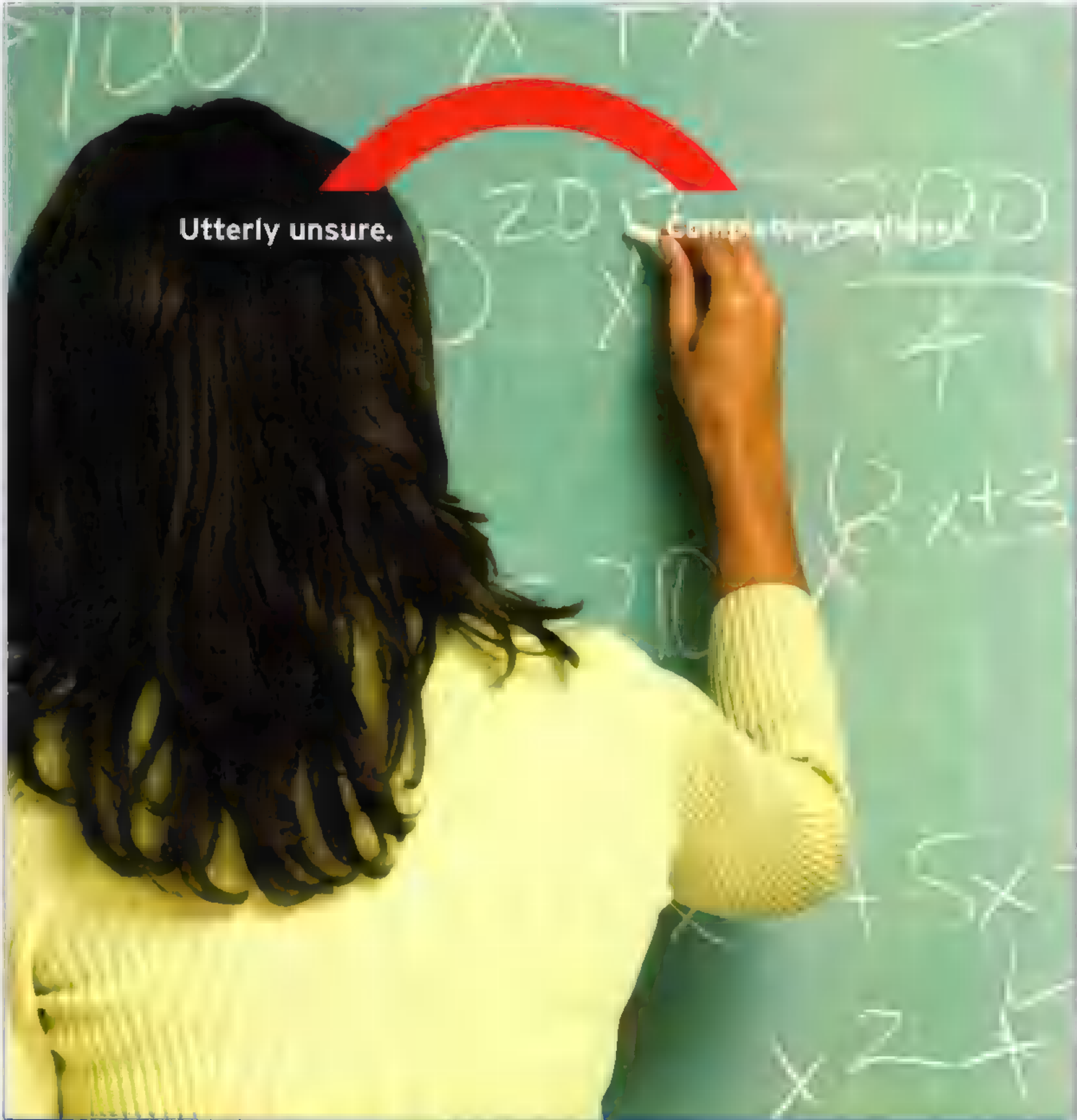
An oncoming storm made the moment for Elmar Rubio, who caught daughters Alice and Bella tossing coats—and cares—to the wind. Rubio is an electrician, artist, and father of seven.

**Kyle Anderson** Prince Albert, Saskatchewan

Kyle Anderson's photo of the swirling northern lights was voted an online audience favorite.







Utterly unsure.

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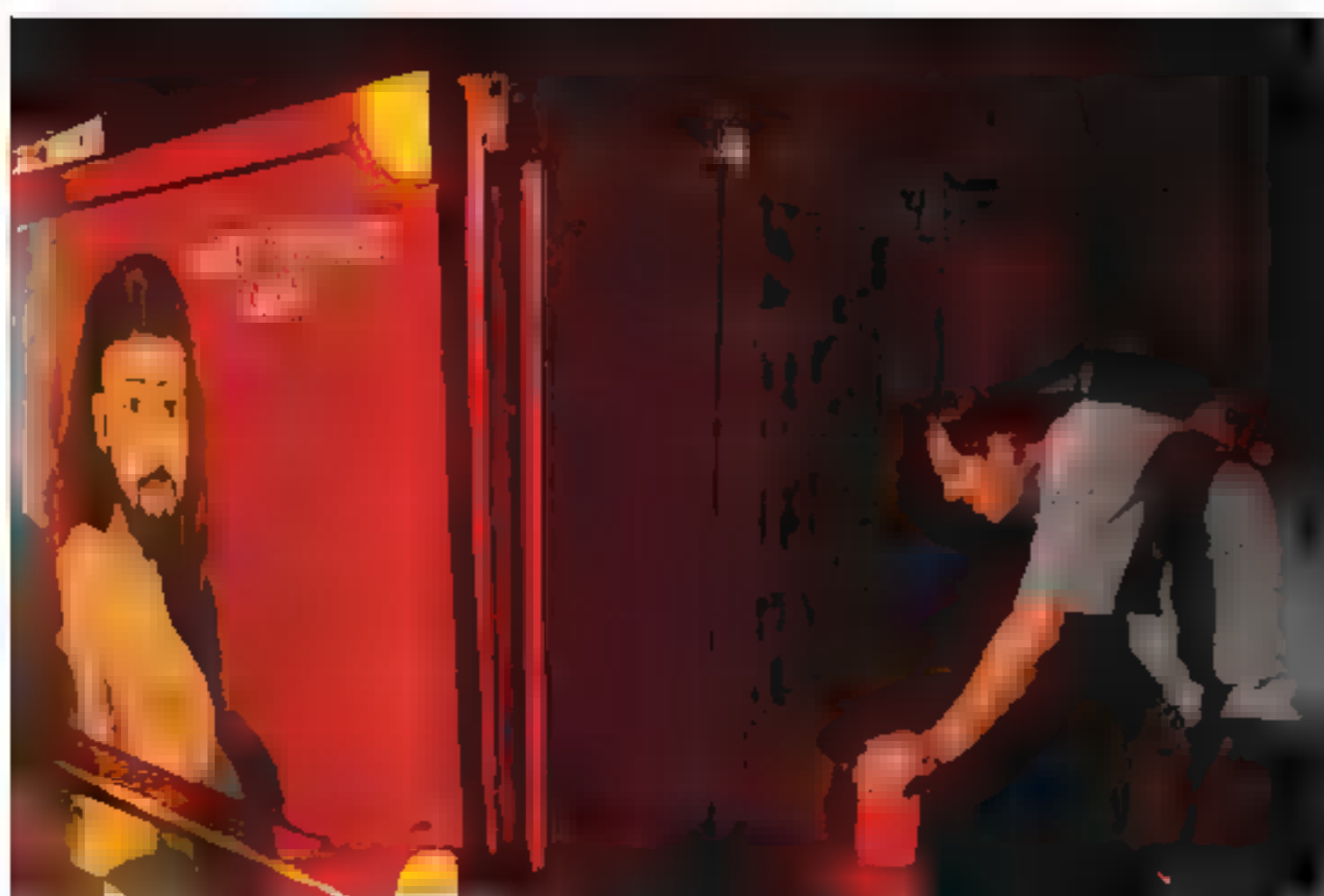
The lurid is the lure at New York City's Coney Island, where fire-eaters and bearded ladies enthrall passersby.

*Nina Berman's most recent book is Purple Hearts: Back From Iraq published by Trolley Books.*

**Summer in the City** I started visiting Coney Island when I first became a photographer, almost 20 years ago. I remember riding the subway out to Astroland. Nearby, at Deno's, I took pictures of a band called the Honeymoon Killers in front of Spook-a-Rama. Later I attended the early Mermaid Parades—the raucous boardwalk costume contests judged by artists, rockers, and blue-haired old ladies. Now the Mermaid Parades draw tens of thousands, and the crowds are so large, police have to stop traffic.

I remember the strange ritual held each July 4 when men gathered around picnic tables and gorged themselves on hot dogs. Now the Nathan's Famous hot-dog-eating contest is known worldwide, drawing groupies who cheer the victors. Six-time winner Takeru Kobayashi competed with a jaw injury last year. He ate 63 hot dogs (and buns)—and still came in second.

Over the past century, Coney Island has had several dramatic face-lifts. Now it has drawn a real estate developer eager to remake the neighborhood yet again, this time into a Las Vegas-style entertainment complex. Coney Island's future is uncertain. But for now its past endures as a terrific place for fun on the cheap—and for street photographers, one of the best shows in town.





He was a  
hardworking farm boy.

She was an  
Italian supermodel.

He knew he would  
have just one chance  
to impress her.

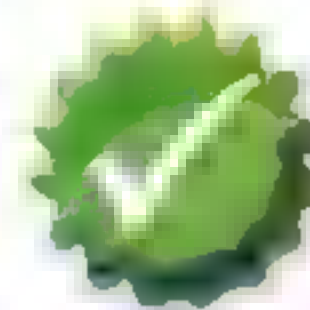
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**Shodo Shima, Japan** Huddled for warmth, macaques press their bodies into a vast ball of fur. The monkeys' relaxed social hierarchy allows high- and low-ranking individuals to share the same tight space.

PHOTO. YUKIHIRO FUKUDA



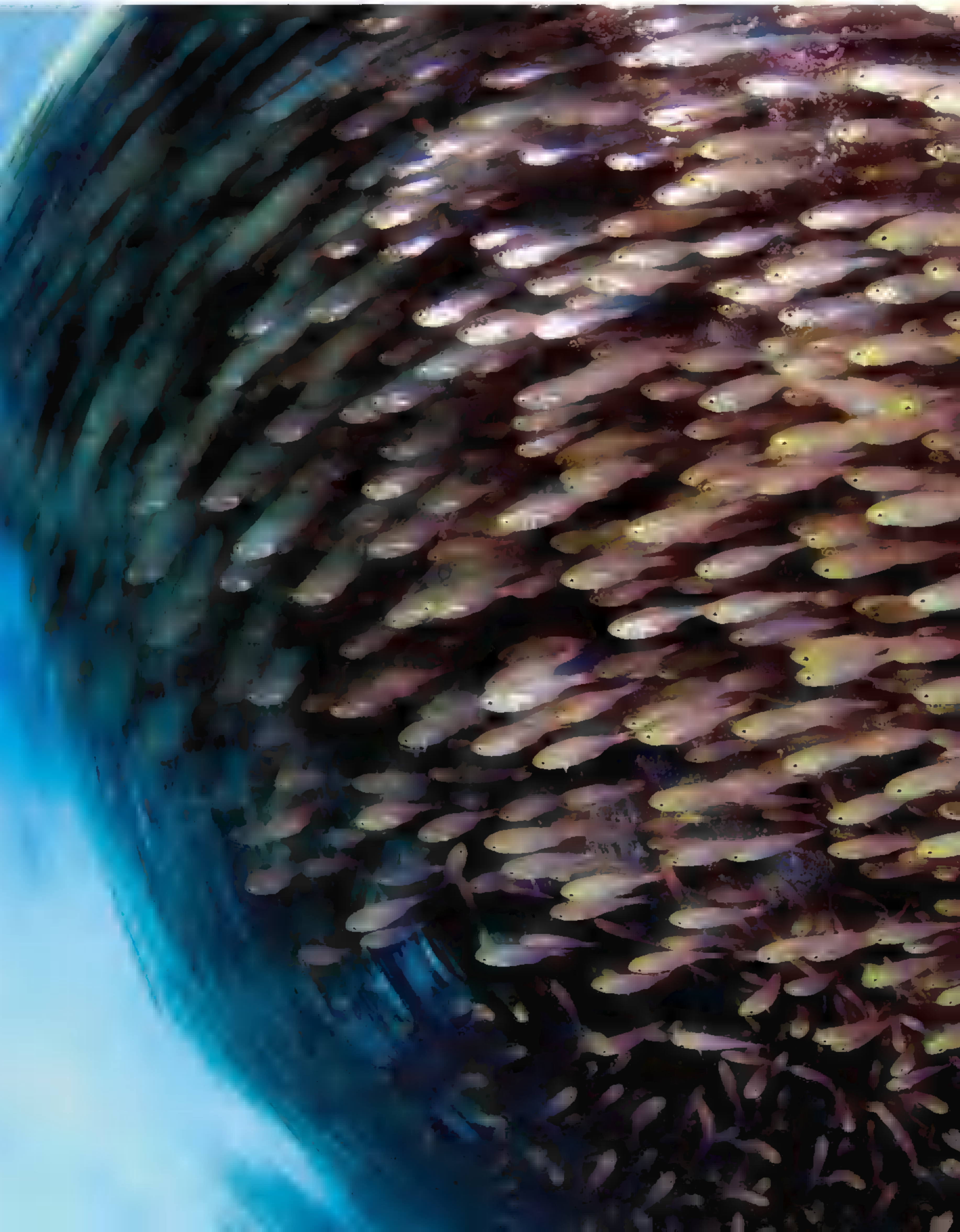
**Qatar** Tour of Qatar cyclists sprint in a quick burst of color past a pipe storage yard outside Umm Said. The flat desert terrain makes for an easy ride, but headwinds can be punishing.



PHOTO. FRANCK FIFE, AFP/GETTY IMAGES



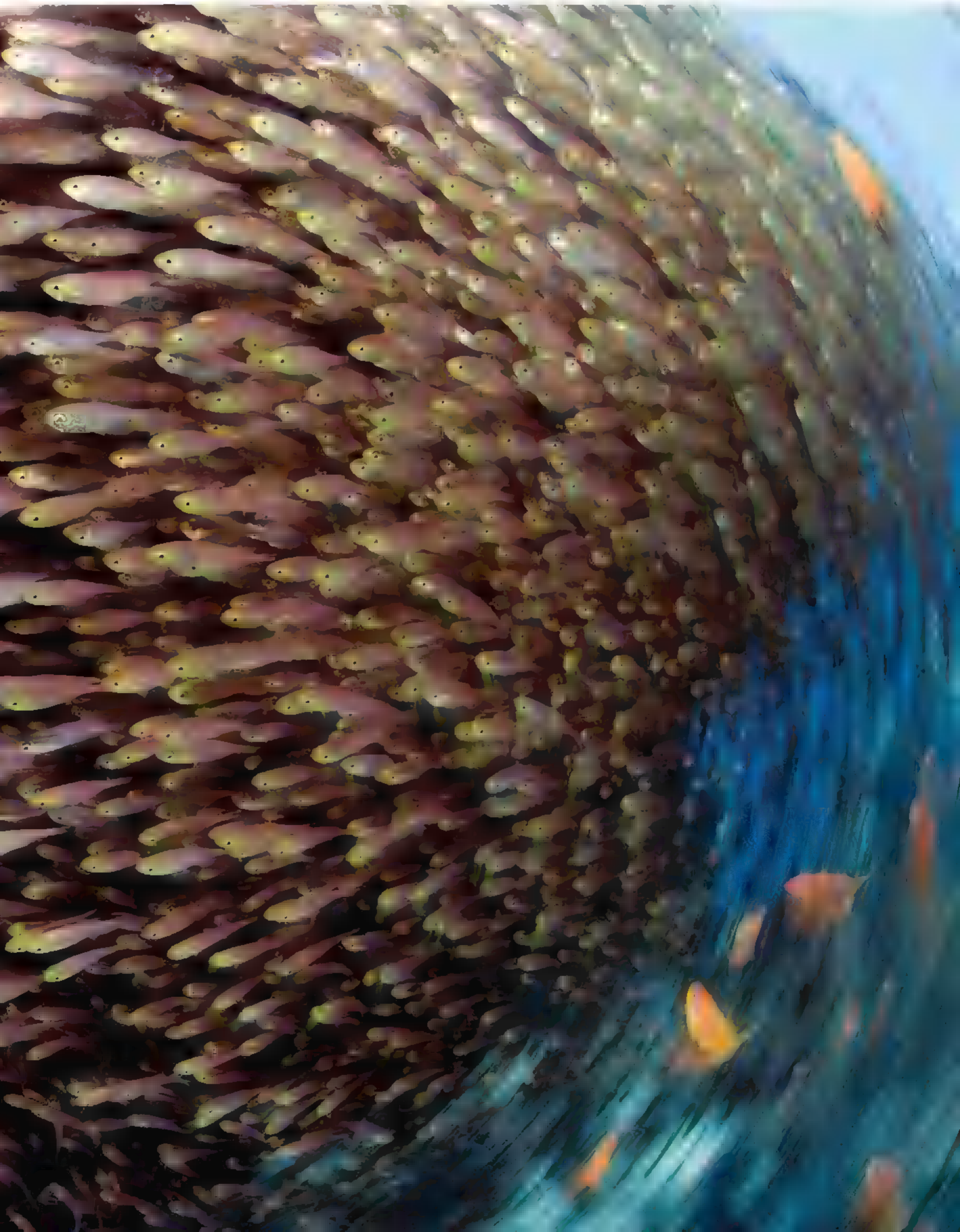
**Gulf of Aqaba** Surrounded by thousands of golden sweepers, photographer Magnus Lundgren spun his camera to capture this shifting school off Eilat, Israel. After 200 tries he got it: a whirlpool of four-inch fish.

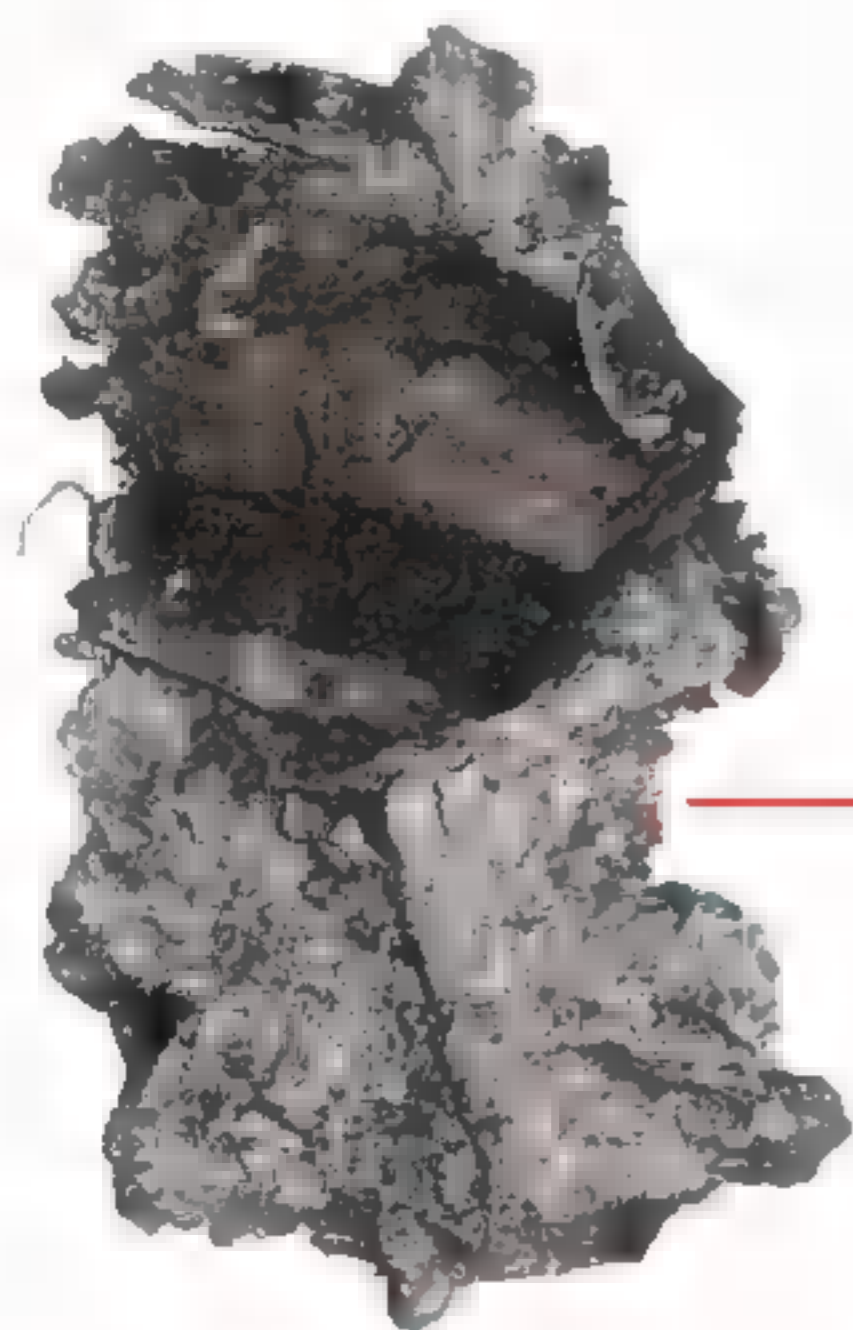




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PHOTO: MAGNUS LUNDGREN

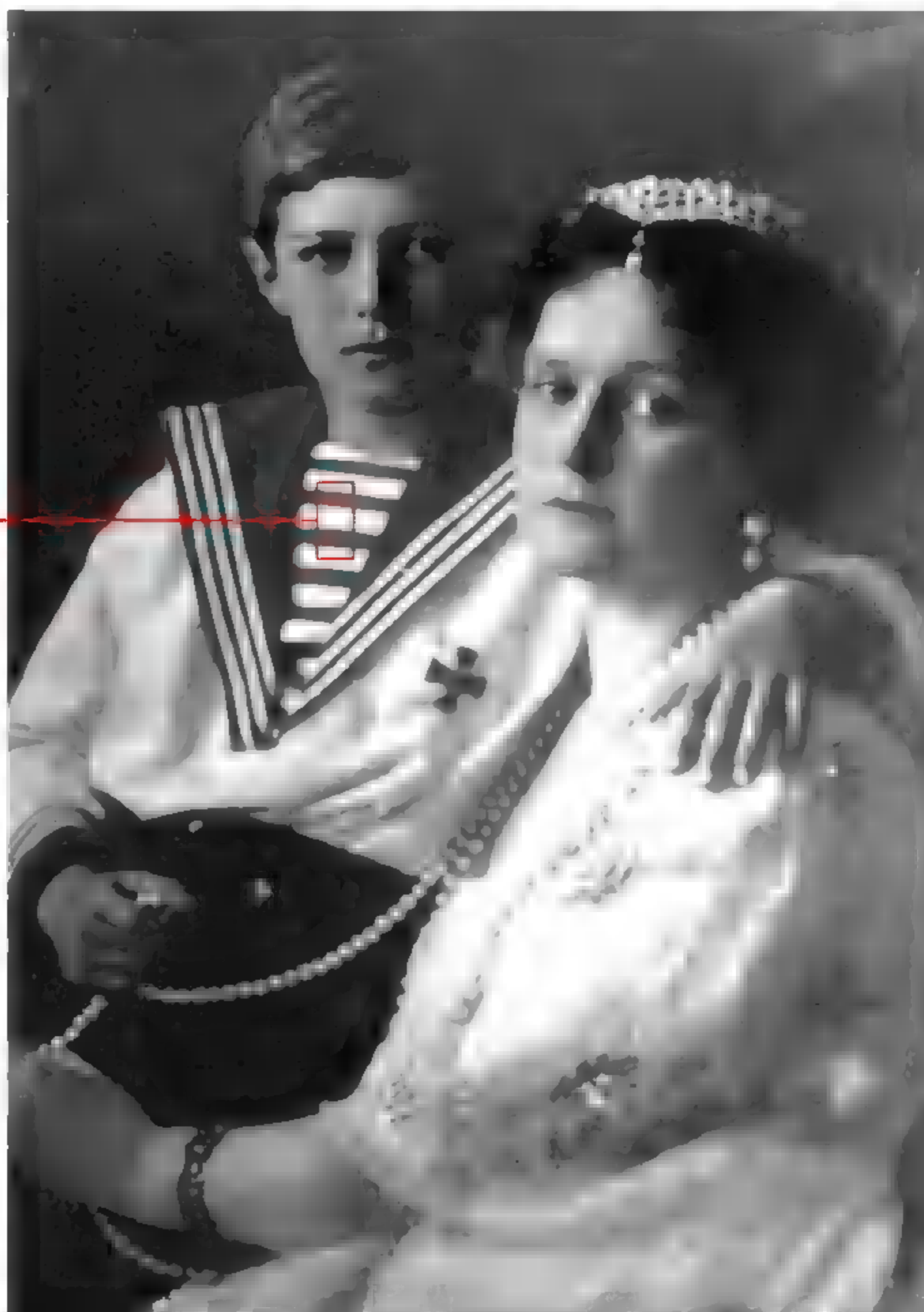




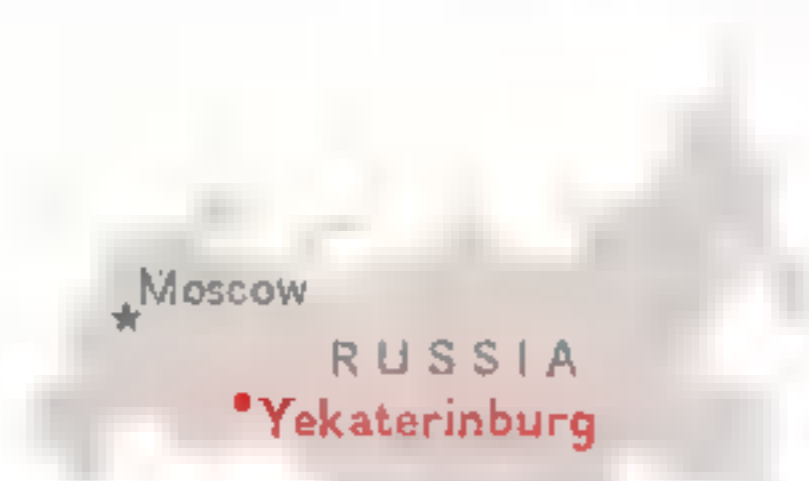
## THE NEWFOUND RELICS

- 44** bone fragments
- 7** teeth
- 3** bullets
- 1** piece of cloth (above, perhaps from the shirt Alexei is said to have worn when executed)

**ALSO** coal, nails, and shards of ceramic (which match vessels found in 1991 that likely held the sulfuric acid used to disfigure the corpses)

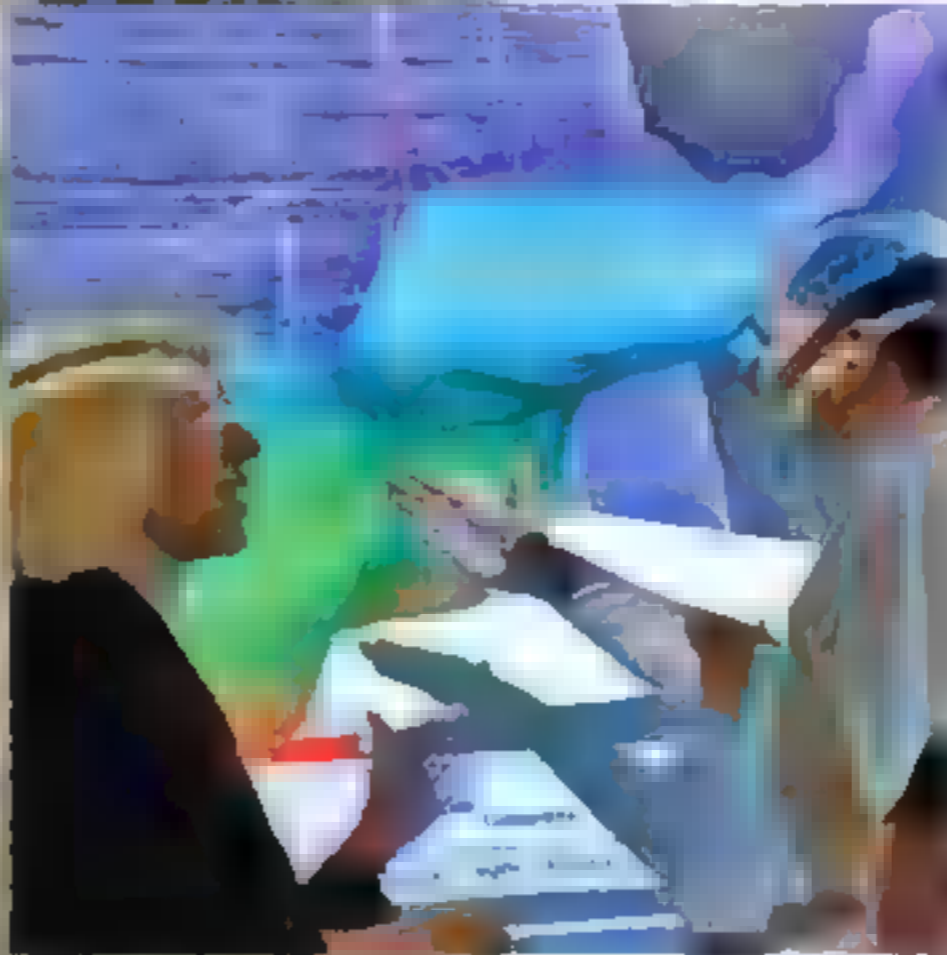


Crown Prince Alexei and Empress Alexandra, circa 1913



**NG GRANT** **Crime and Denouement** The fate of Russia's last royal family has inspired myth and mystery. Maybe no more. A dig last year near Yekaterinburg may have turned up the remains of two missing Romanov children: Alexei and either Anastasia or Maria. After rereading a 1934 note from a Bolshevik executioner, researchers found the spot—about 200 feet from a field that in 1991 yielded nine bodies identified as Tsar Nicholas II, his family, and servants. Then they poked a metal rod into soil whose give indicated a disturbance. What they unearthed (top left) could end 90 years of dispute. In 1917 the imperial clan was spirited to the Urals. The next year, on Lenin's orders, they were shot, stabbed, burned, and buried. Yet the legend that some escaped has endured; prior forensic evidence is still debated. This new find and the DNA testing it has prompted may finally close the case. —*Jeremy Berlin*

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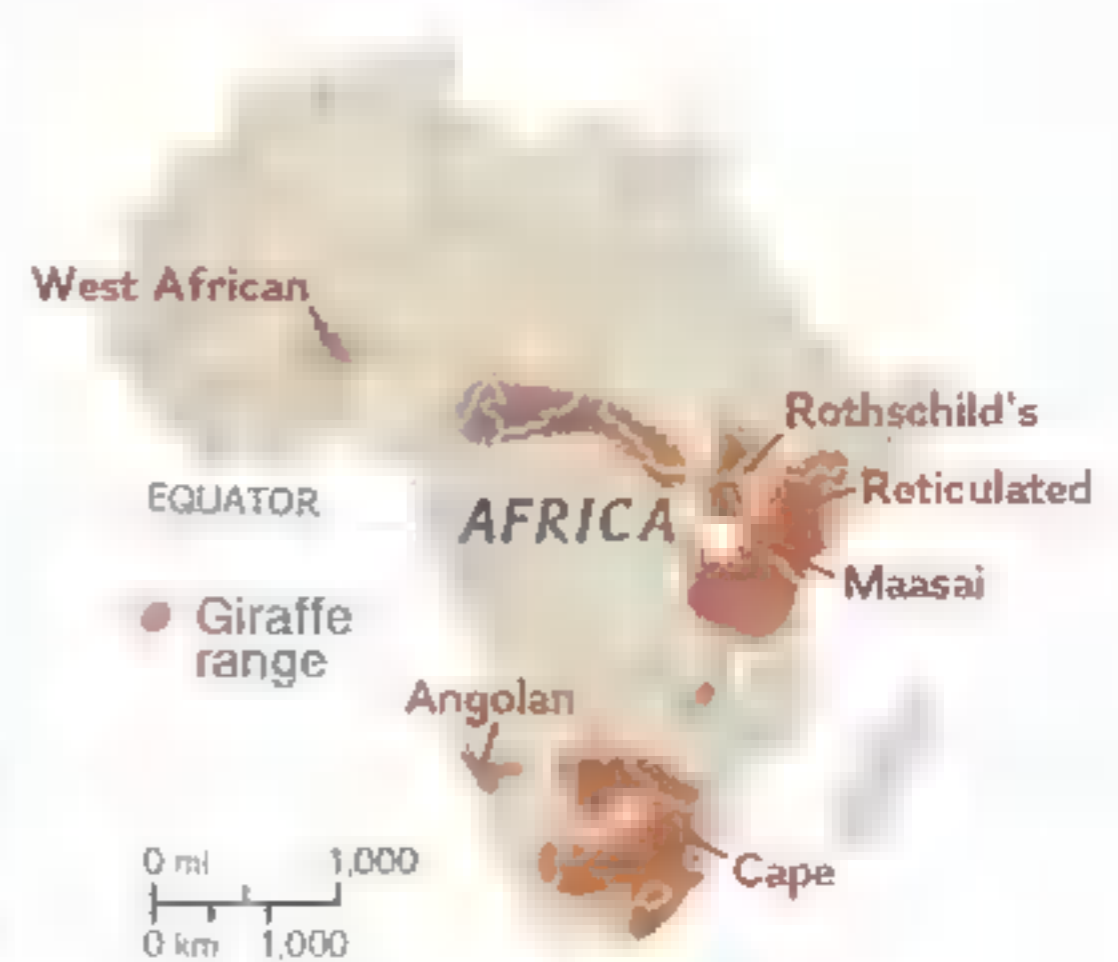
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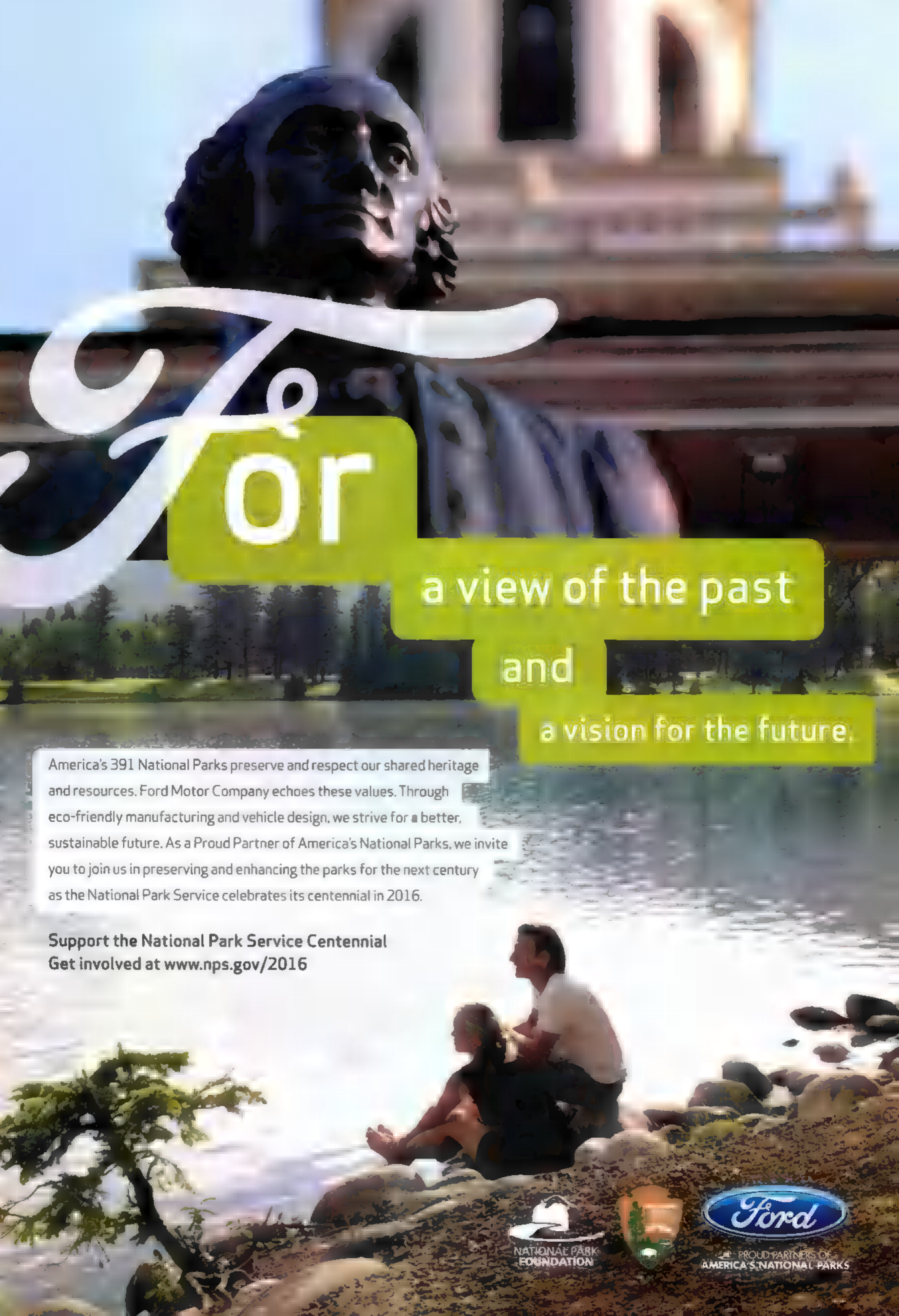


Of nine types of giraffe, these six (above) are now known to be genetically distinct.

**Spot Check** If on a savanna in East Africa a male Maasai giraffe with jagged spots approaches a female reticulated giraffe with rounded patches, would they mate? In zoos they might, but in the wild they don't, even if they share territory. Recent genetic testing suggests why. Rather than one species, as was thought, there may be at least six. Giraffes stick to their own kind—a mark of speciation—possibly by recognizing coat pattern. (The pattern also plays a role in camouflage.) It will take years for giraffes' official classification to change. Meanwhile, their numbers are down an estimated 30 percent as habitat has dwindled, and only a few hundred Rothschild's and West African giraffes remain. —Tom O'Neill



ART. ALDO CHIAPPE. SOURCE: DAVID M. BROWN  
NGM MAPS. SOURCES: JULIAN FENNESSY, ROD EAST



For

a view of the past

and

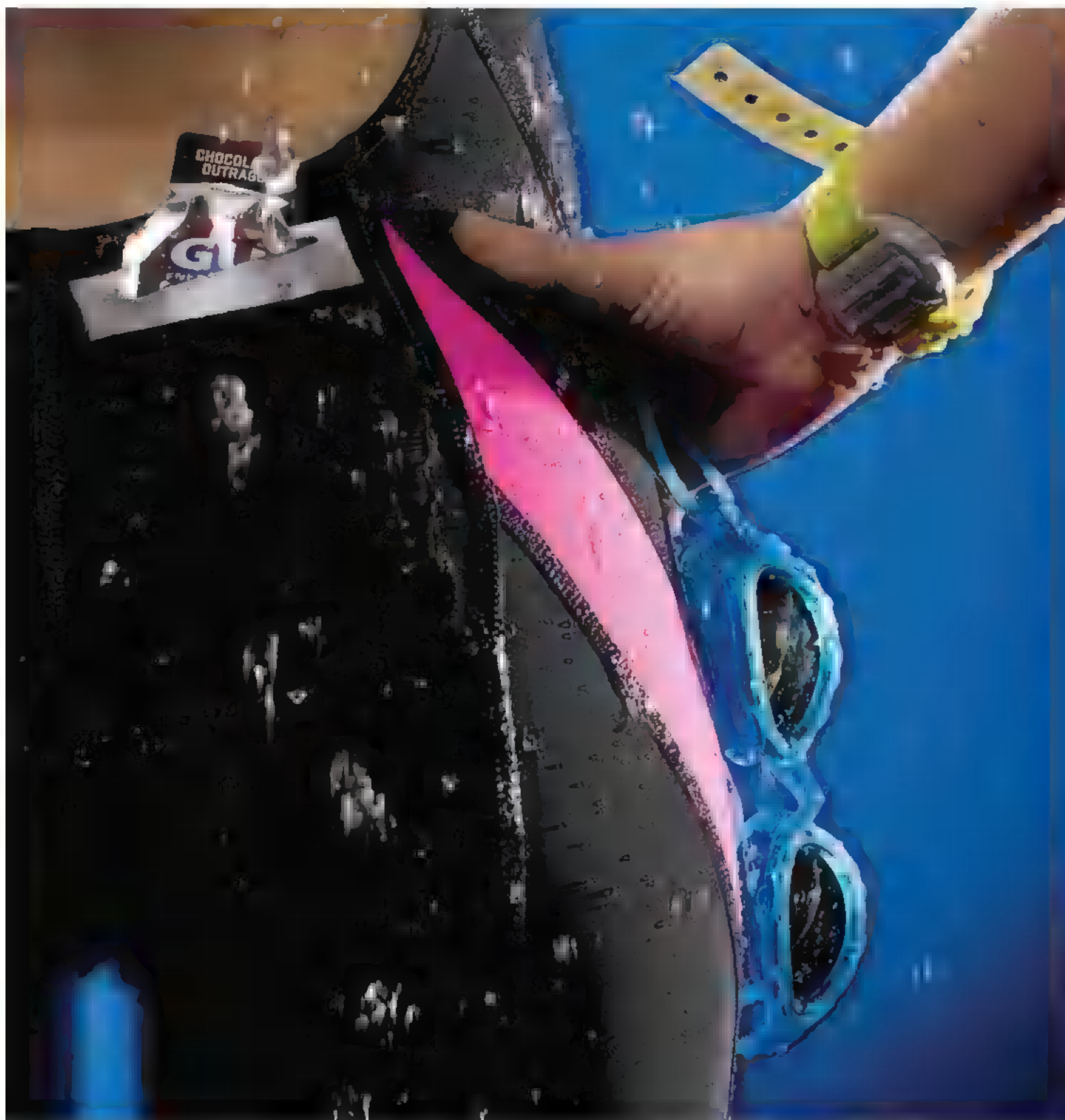
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**Swimming With the Jellyfishes** Olympians once raced in rivers, lakes, and seas. Brrrr. "My will to live completely overcame my desire to win," said Alfred Hajos of Hungary, who braved 55°F Aegean waters in 1896. The Olympics switched to pools, but the age-old sport of open-water swimming didn't dry up. In fact, in the 1960s it came of age. Some swimmers don't mind jellyfish, currents, and cold, and do like racing 10, 20, 30 miles or more.

Now the long-distance swim hits the Olympics with a 6.2 miler in Beijing—except the venue is the clean, spectator-ready artificial rowing basin. Still, there'll be lots of drama. "Everybody charges in," says expert Dave Barney. Midway, they grab drinks from sticks held by coaches. And elbows fly. "It's not a contact sport," says U.S. hopeful Chip Peterson. "But sometimes it becomes one." —*Marc Silver*

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# HISTORY

**Subway Starts** In 1933 draftsman Henry Beck was paid five guineas for his new map of the London Underground. Instead of placing stops on an accurate depiction of the city, he created a connect-the-dots rendering of train lines (below), borrowing from electrical diagrams. Aboveground geography was abandoned, except for a line depicting the Thames. Yet his streamlined approach did not clash with mental images of the city. At 75, Beck's map represents not just the Tube but London itself, says sociologist Janet Vertesi—and has inspired subway maps everywhere. Below, more underground milestones. —Linda Kulman

**1863**  
The Tube opens in **London**: world's first subway system.



**1953**  
**New York** token is born, lasts until 2003. Cause of death: fare cards.



A 1938 medal marks a second wave of **Moscow** subway construction.

**1940-41**  
**Londoners** take refuge in Tube stations during the Blitz.

**1935**  
**Moscow Metro** opens. Ornate stations, some with chandeliers, seen as a way to bring art to the masses. A male voice announces inbound travel; a female voice, outbound.

**Los Angeles** opens its subway; mastodon bones, 2,000 fossils dug up during construction.

**2001**  
**Washington, D.C.**, Metro completes its original plan for \$10 billion—the most expensive single public works program in the U.S. until Boston's Big Dig.

**2007**  
Rising gas prices lead to 3% increase in **U.S.** subway trips, for a total of three billion.

**1995**  
Sarin gas attack on **Tokyo** trains kills 12 people, hospitalizes 493—first chemical terrorism on public transport.

**Beijing's** rapidly growing subway predicted to be largest in the world by **2015**.

**Boston** opens first U.S. subway. Excavation harms church; pastor blames "devil."

**1897**



**1913**

**Buenos Aires's** Subte opens; oldest system in Latin America.

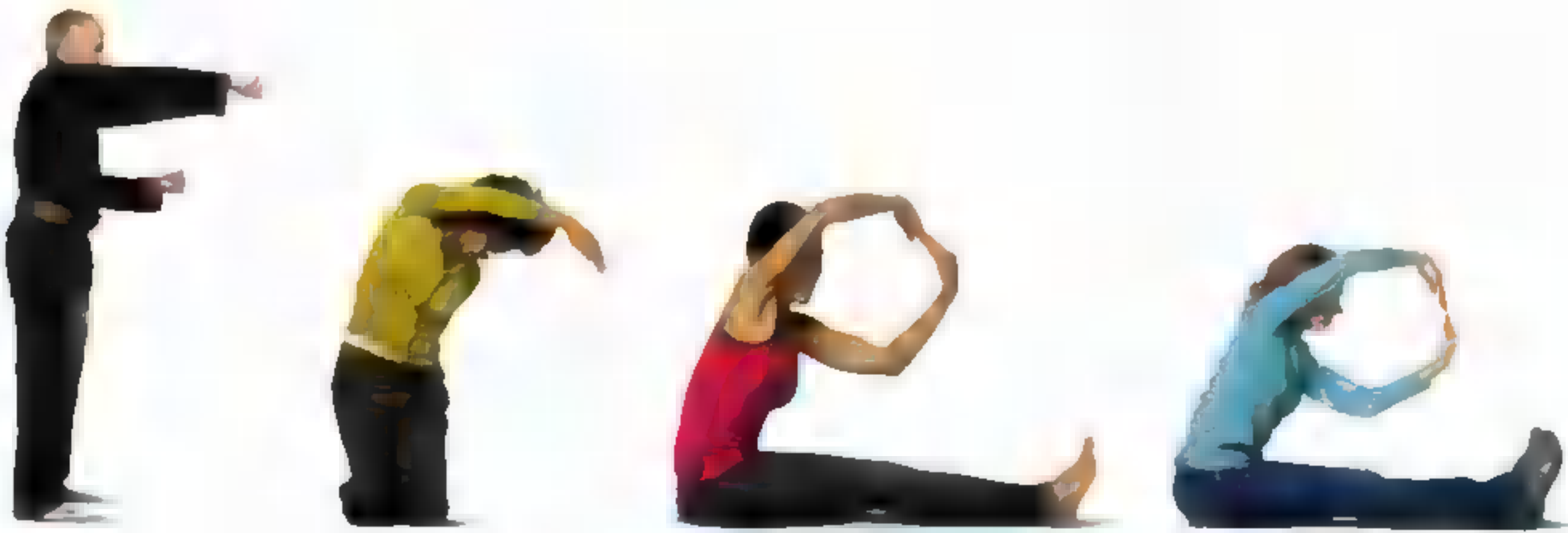
## ANNUAL SUBWAY PASSENGER TRIPS (2006)

- Tokyo** 2.9 billion
- Moscow** 2.6 billion
- Seoul** 2.4 billion
- New York City** 1.5 billion
- Mexico City** 1.4 billion
- Paris** 1.4 billion
- London** 971 million
- Osaka** 880 million
- Hong Kong** 867 million
- St. Petersburg** 810 million



Signs are artful on **Paris's** Metro.





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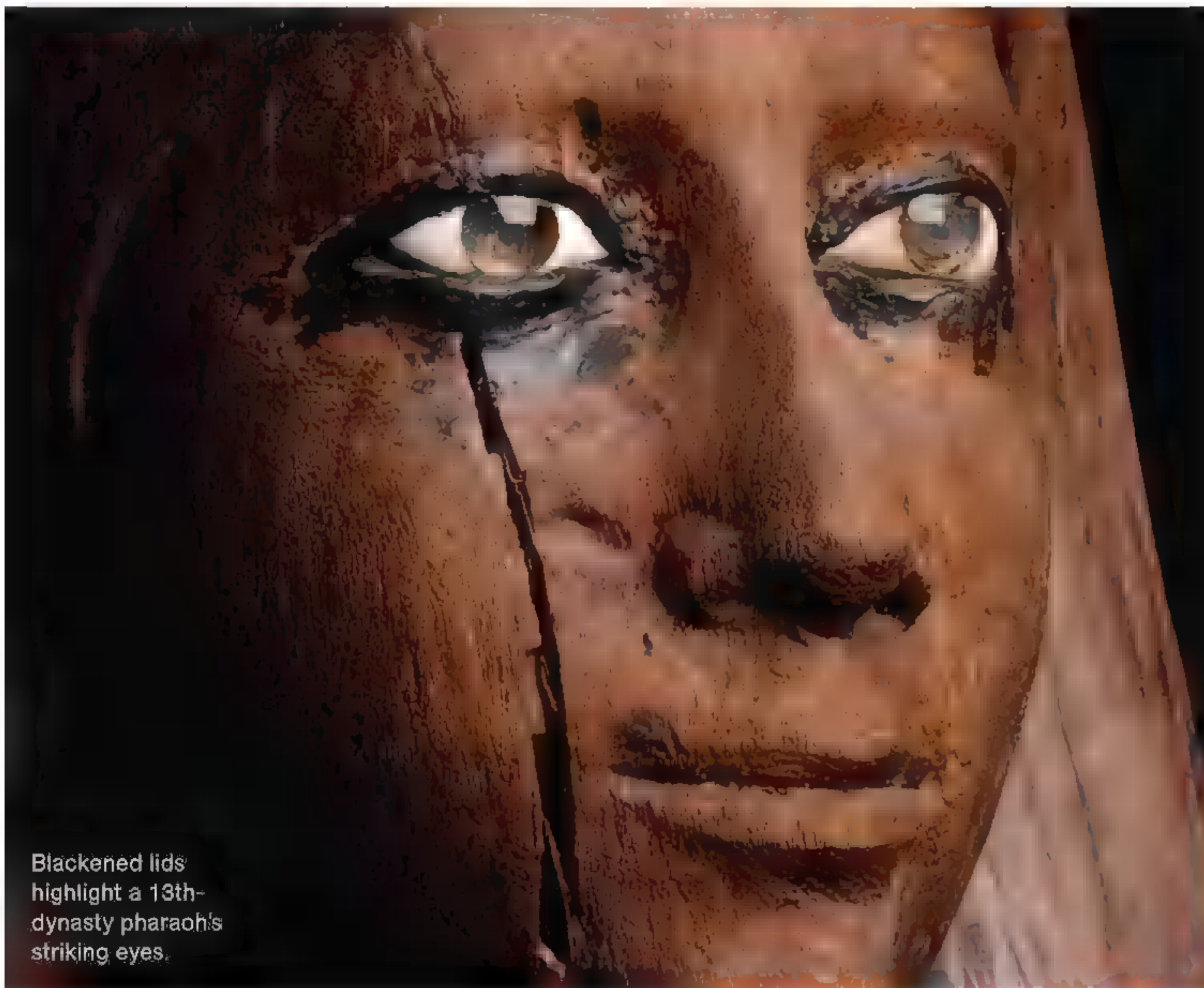
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Blackened lids highlight a 13th-dynasty pharaoh's striking eyes.

**Nile Style** Egyptian eyes are back in fashion, with celebrities lining their lids à la Cleopatra. Then as now, the desired effect was to make the eyes pop. In ancient Egypt, though, enhancing one's appearance had spiritual aspects as well. A luxurious wig stiffened with beeswax, for instance, was a potent sexual symbol that linked the wearer to Hathor, the goddess of beauty.

Green eye paint, or *wadju*, may have invoked Hathor's protection. In death, cosmetics created a youthful,

fertile look deemed essential for rebirth in the hereafter. Used by both men and women, makeup may also have had earthly benefits. Black eyeliner—known as *mesdemet* in antiquity, and *kohl*, from the Arabic, today—reportedly kept away flies, cut the sun's glare, and contained lead sulfide and chlorine, which acted as disinfectants. (No evidence survives of any toxic results from the lead.) Oils and creams, often scented, kept skin moist in the dry climate; some were even given as wages. There were also many wrinkle remedies—likely as questionable as the ones today. —A. R. Williams



Makeup was on the minds of Egyptians, alive or dead. Elite burial objects include a cosmetic spoon (above), tubes to store eyeliner, and jars for moisturizers.



# ENVIRONMENT

**Dying to Be Green** Death, it turns out, is bad for the environment. The end of life is often followed by the start of a process steeped in toxic embalming fluids and marked by the consumption of resources—a U.S. funeral typically costs about \$6,000. One alternative is the green burial movement, which began in England in the 1990s and has since spread around the world. Embalming is skipped (it's usually not required by law unless there's a long delay or the body crosses certain state lines). Biodegradable materials like paper are used for shrouds, coffins, and crematory urns.

The burial site matters too, says Joe Sehee, founder of the Green Burial Council. A growing number of cemeteries cater to clients who want their remains to return to the earth beneath land uncluttered by headstones or mausoleums.

Brenda Proffitt, of Albuquerque, New Mexico, and her husband recently bought plots in a green cemetery in the high desert. Like many of the graves, theirs will be unmarked. A GPS device will record the location, beside a boulder and a few pines. "I pretty much live by the reduce, reuse, recycle mantra," Proffitt says. She likes the idea of returning to ancient, no-frills burial traditions while embracing her 21st-century values. —Neil Shea



## GONE FOREVER

Burial inters more than a body. Below, a roundup of what else goes under in the U.S. each year.

- **30 million board feet** of casket wood, including tropical hardwoods
- **90,000 tons** of steel—more than enough to build the Golden Gate Bridge
- **1.6 million tons** of concrete in burial vaults
- **Over 800,000 gallons** of embalming fluid, more than enough to fill an Olympic-size pool



The Ecopod coffin is made of recycled newspaper and vegetable matter. So is the Acorn urn (top), designed to hold ashes.



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Classic pour: Place sugar cube atop slotted spoon; drip water over it into glass of absinthe. Dramatic flourish: Dip cube in absinthe and set aflame.

## Absinthe Encore

It has a bright-looking future but, like some of its famous fans, a tortured past. Hemingway drank absinthe and did “knife tricks.” Toulouse-Lautrec was rumored to have toted it in a hollow cane while brothel hopping. The liquor known as the green fairy flowed in the 19th century, notably in bohemian Paris. Why? It was cheap and accessible, says distiller T. A. Breaux. “Phylloxera had devastated French vines, so wine was scarce—and expensive.” But in 1905, when a Swiss man killed his family after drinking absinthe, the already suspect spirit (linked to van Gogh’s 1888 ear cutting and said to induce hallucinations) was declared unsafe and later outlawed around the world. Fast-forward a hundred years: Science has shown that thujone, a chemical in wormwood (the drink’s key agent), is safe in small doses, and the notorious tippie is legal—and popular—once again. Says Breaux: “I just hope it doesn’t get so trendy it burns itself out.” —Catherine L. Barker

### THAT’S THE SPIRIT

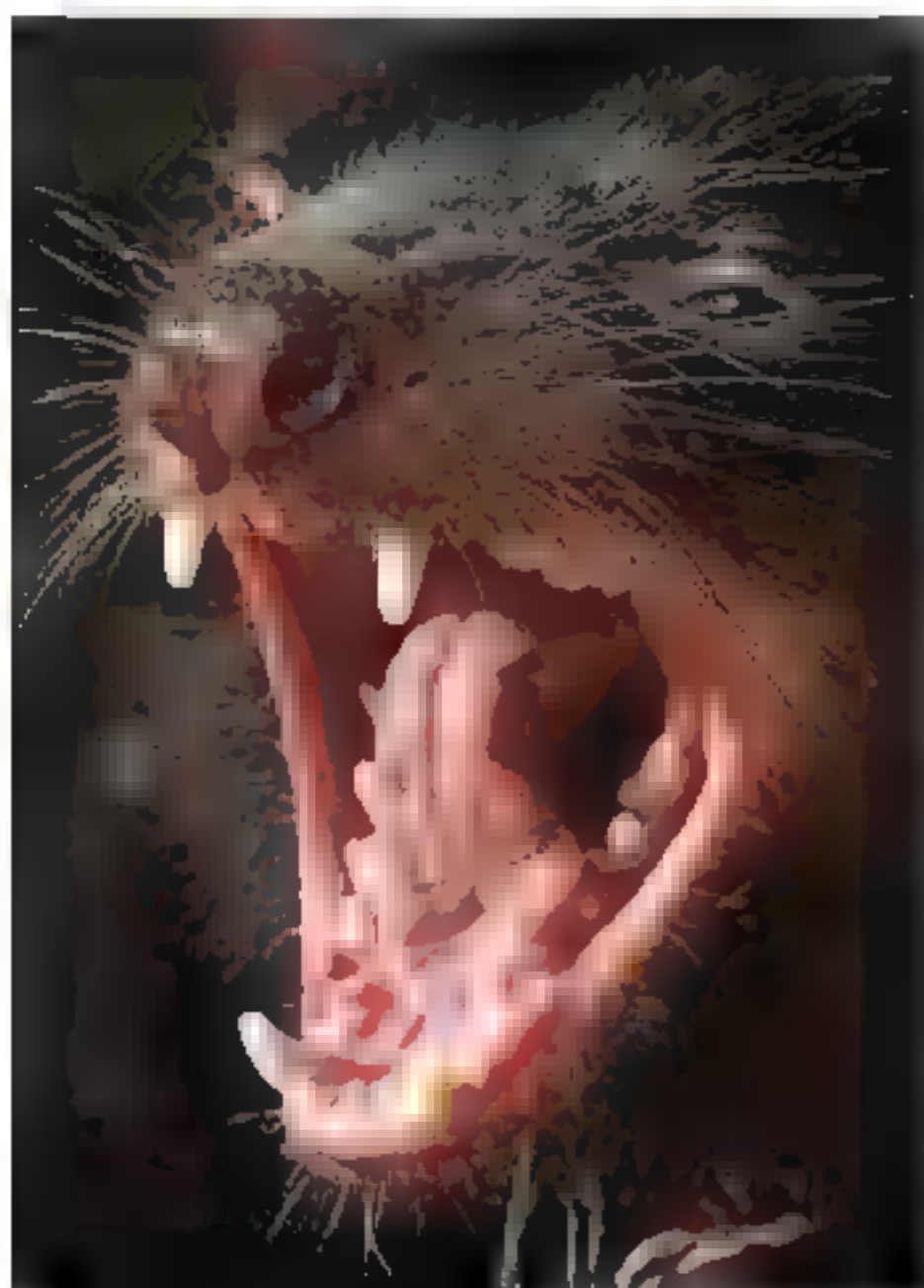
- **Origin** Absinthe as we know it was invented in the 18th century in Switzerland and was first used as a medicinal elixir.
- **Flavor** Distilled from wormwood, anise, and herbs, it tastes strongly of licorice, faintly of lemon.
- **Look** Clear green turns cloudy white when water is added. This effect, called the “louche,” is the mark of genuine absinthe.



Rev. Al Sharpton and Rev. Pat Robertson, Virginia Beach, VA

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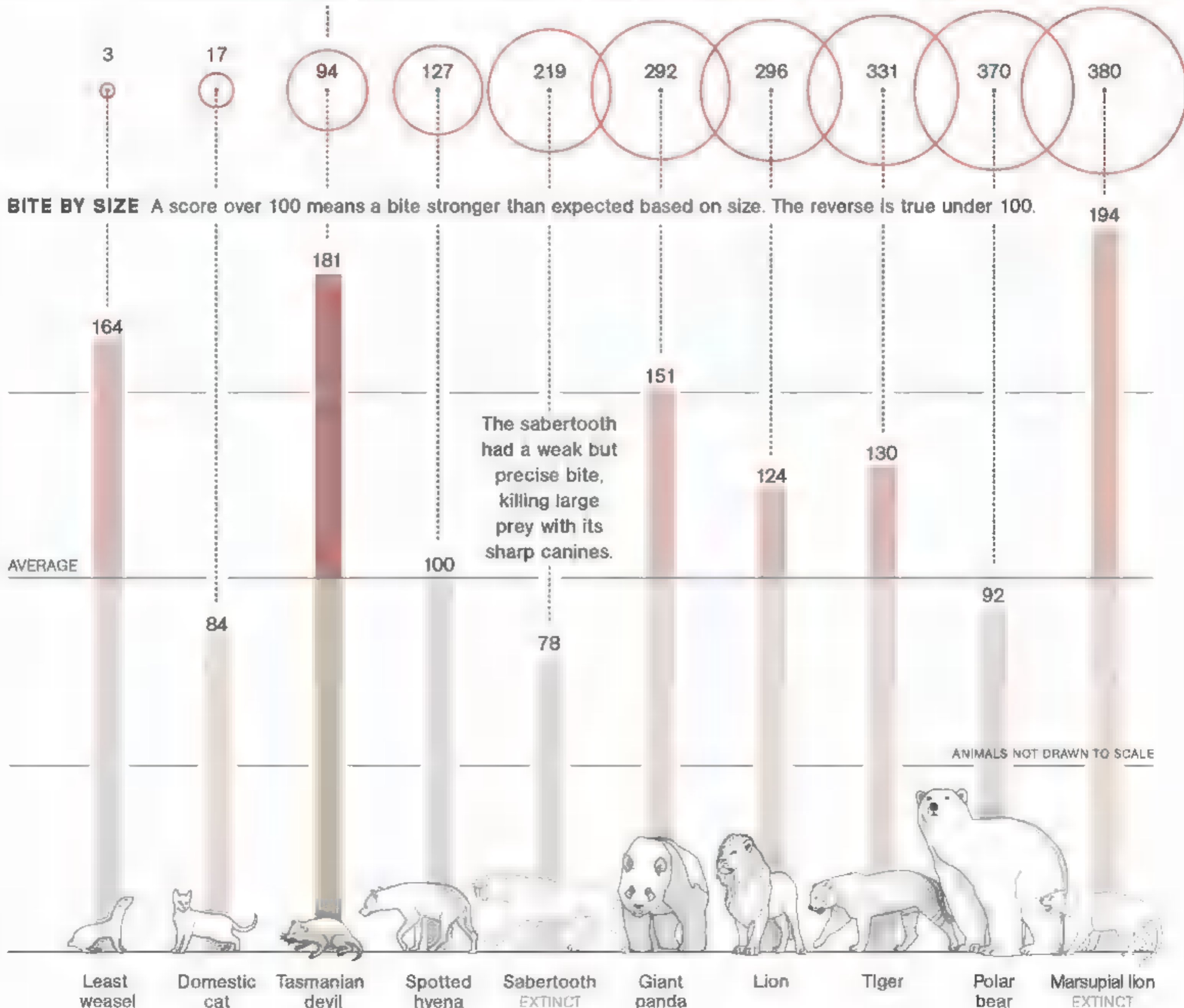


Tasmanian devil

**Nasty Bites** Carnivorous mammals are famous for their big, sharp teeth. But which one boasts the fiercest bite of all? To learn more about the behavior of extinct meat-eaters, a group of scientists led by Australians Stephen Wroe and Colin McHenry calculated the bite force of 151 living carnivores, then adjusted for their size. The Tasmanian devil, least weasel, and other carnivores that take prey larger than themselves emerged on top, with by far the most powerful bite for their size. The giant panda, a member of the carnivore order that eats mainly tough bamboo stalks, also ranked high.

But no carnivore present or past could match the bite of the marsupial lion, a 300-pound predator that lived in Australia during the Ice Age. It must have specialized in bringing down large prey, says Wroe, and that was its undoing. Unlike today's weaker-biting big cats, this fearsome but lumbering hunter probably wasn't swift enough to catch smaller prey. When its oversize food supply went extinct, so did the marsupial lion. —Karen E. Lange

**BITE FORCE** Measurements of skulls and attached muscles are used to estimate maximum pounds of force.

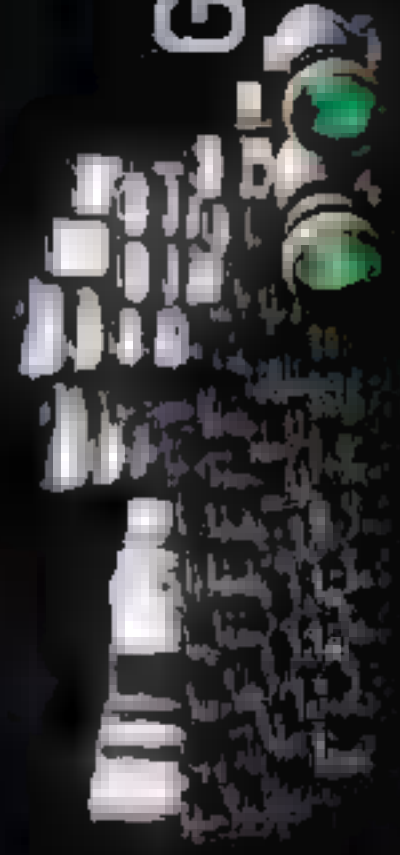




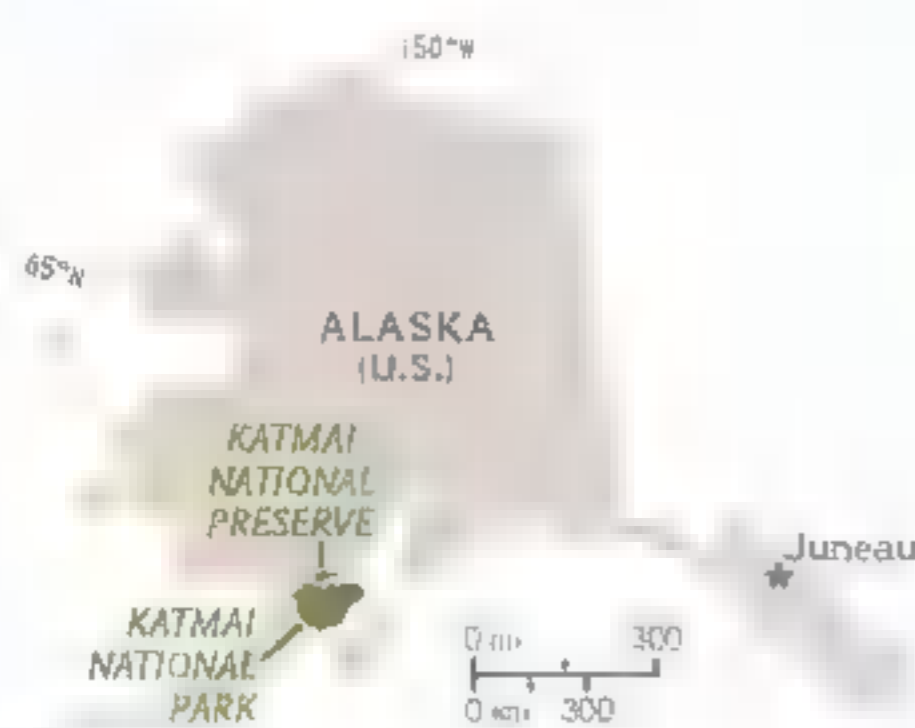


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Hunters stalk a feeding bear in Alaska's Katmai National Preserve.

## A View to a Kill

Fair hunt or heinous hit job? A video of hunters shooting a brown bear is circulating on the Internet—and inflaming debate over a highly divisive issue on the Alaska Peninsula.

The bear in the video was killed legally last October during the biennial 21-day fall hunt in Katmai National Preserve. The preserve abuts Katmai National Park and other protected lands that make up a 3.7-million-acre brown bear refuge, the world's biggest. Activists say that bears there are habituated to the tourists and anglers who arrive each summer, so when the animals amble into areas sanctioned for hunting (right), they don't flee at the sight of people.

Biologists say the preserve's brown bear population of about 580 is robust, and that the fall 2007 hunt yielded a "sustainable harvest" of 21 bears. Critics are unswayed: Killing unwary bears at close range, they claim, violates the ethic of "fair chase," a term open to interpretation. "Most hunters define [it] as giving a wild animal a chance to get away if it wants to," says biologist Larry Van Daele, "but that wouldn't fit the bear-watchers' definition. For them, it's a much more emotional issue." —Peter Gwin





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## WHERE IN THE WORLD?



Makgadikgadi, the name of this salt-covered flat, is Setswana for “vast, open, lifeless land.”

**Salty Solitude** A bull elephant's heavy steps carve a lonely trail across the salt-covered Makgadikgadi Pans in northeastern Botswana. Millennia ago, the region lay beneath a massive lake, fed by the Chobe, Okavango, and Zambezi Rivers. Erosion, climate change, and other factors altered the rivers' paths. They stopped feeding the lake; it slowly dried up, leaving a saline crust behind.

Now, heavy rains fill the pans and soak nearby grasslands, luring parched pachyderms. In the dry season, May to November, the water disappears. Herds move on—for the most part. Since elephants do not typically mate with kin, matriarchs nudge out the bulls when they're about age 12. Roaming alone or in bachelor groups, the bulls don't need as much water as a full herd. They may be able to stay on the edges of the salt flats all year, digging for tubers or visiting man-made water holes if thirsty. At age 25 or so, bulls go looking for herds, where females and temporary trysts await. —*Oliver Uberti*



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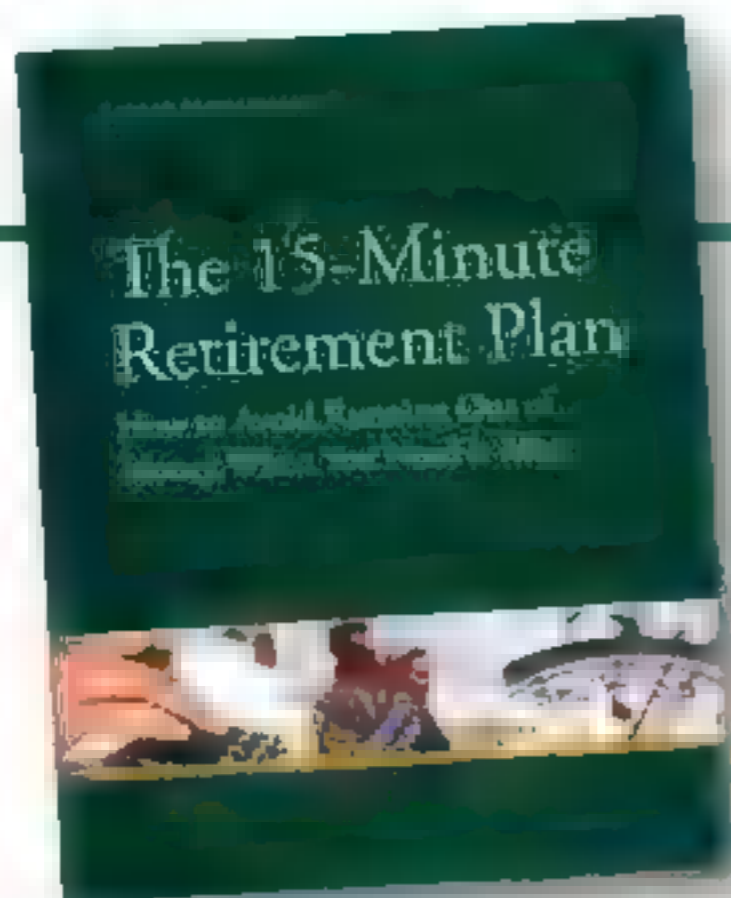
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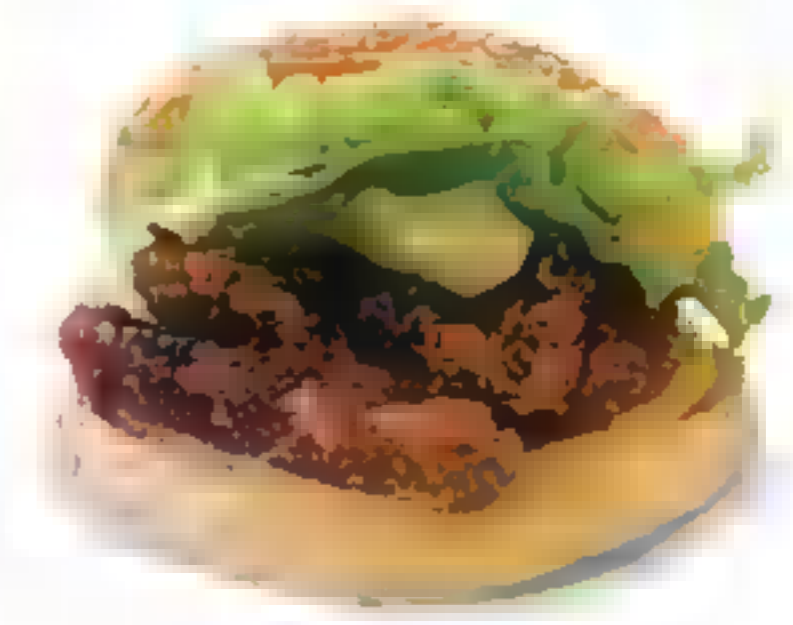
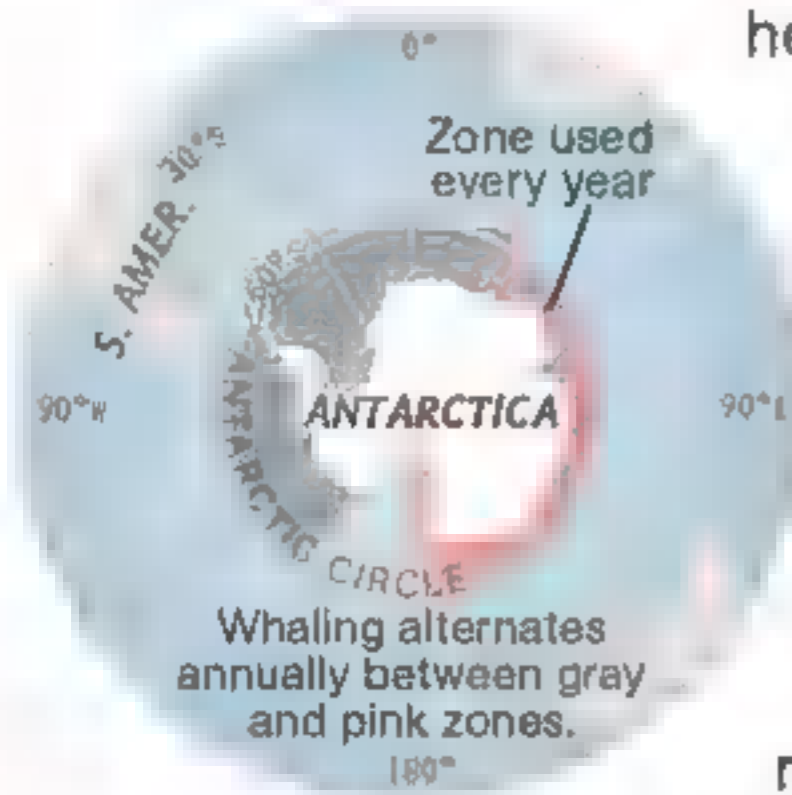
# CONSERVATION

**An Appetite for Whaling** Japan catches hundreds of whales every year. That would seem to violate the 1986 moratorium on commercial whaling. Not everyone sees it that way. Close to its shores, Japan targets Baird's beaked whales, dolphins, and other small cetaceans, arguing that their size exempts them from the ban. Large whales are hunted mainly off Antarctica as "scientific whaling."

What kind of science are the whales dying for? The research includes questions about their diet that can be answered only by killing them. Many experts say that information won't help the International Whaling Commission (IWC) manage the world's whales if commercial whaling were to start again.

Japan is the only nation now doing scientific whaling, although Iceland has in the recent past. Any country can issue itself a permit to kill whales for research. The IWC reviews permits but cannot reject them.

Japan, which sets its own quotas, has killed more than 10,000 large whales since starting its scientific whaling program in 1987. The meat is sold, legally, in markets. Bob Brownell of the National Oceanic and Atmospheric Administration says many scientists think scientific whaling is "just commercial whaling in disguise." —Helen Fields



## WHALE BURGER

Served at a restaurant in Japan, the fried filling is minke whale from the country's scientific whaling program.



Students on a field trip watch the butchering of a Baird's beaked whale, a species commercially hunted in Japan.



**BY MARK JENKINS**

NATIONAL GEOGRAPHIC CONTRIBUTING WRITER

**PHOTOGRAPHS BY BRENT STIRTON**

# WHO MURDERED THE

Heavily armed militias shatter the stillness in this central African park. Desperate refugees crowd park boundaries. Charcoal producers strip forests. Then, last summer, someone killed seven of these magnificent creatures in cold blood.





**VIRUNGA GORILLAS?**



**PHOTO SEEN AROUND THE WORLD** Grieving villagers carried Senkwekwe, a 500-pound silverback, from Virunga Park on July 24, 2007. — murder, and that of half his family, ignited worldwide outrage. Poachers were unlikely suspects: They remove body parts such as head and hands to sell as souvenirs.





**Undeterred by a warning cross where Hutu rebels recently attacked park rangers, UN forces advance up Nyiragongo volcano. The rebels cut trees and produce charcoal in the park, a lucrative trade that is destroying the forest. Their presence is also keeping out tourists. On this patrol, the blue-turbaned Sikh peacekeepers routed the rebels without firing a shot.**



**THE KILLERS WAITED UNTIL DARK. ON JULY 22 OF LAST YEAR UNKNOWN ASSAILANTS CROUCHED IN THE FOREST, PREPARING TO EXECUTE A FAMILY OF GORILLAS. HIDDEN ON A SIDE SLOPE OF THE MIKENO VOLCANO IN EASTERN DEMOCRATIC REPUBLIC OF THE CONGO, ARMED WITH AUTOMATIC WEAPONS, THE KILLERS HAD HUNTED DOWN THE TWELVE-MEMBER RUGENDO FAMILY, WELL-KNOWN**

among tourists and well loved by the rangers of Virunga National Park. The patriarch of the gorilla family, a 500-pound silverback named Senkwekwe, would have sensed that the assailants were near, perhaps wrinkling his wide, black nose at their unfortunate smell, but he would not have been alarmed. Senkwekwe had seen thousands of people and had come to accept their proximity as irritating but unavoidable. So habituated to humans was the Rugendo family that the gorillas would occasionally wander out of the forest into cornfields for an impromptu picnic, angering local farmers.

Park rangers at the nearby Bukima barracks said they heard shots at eight that night. On foot patrol the next morning they found three female gorillas—Mburanumwe, Neza, and Safari—shot to death, with Safari's infant cowering nearby. The following day Senkwekwe was found dead: blasted through the chest that same night. Three weeks later the body of another Rugendo female, Macibiri, would be discovered, her infant presumed dead.

Just a month earlier, two females and an infant from another gorilla group had been attacked. The rangers had found one of the females, shot execution style in the back of the head; her infant, still alive, was clinging to her dead mother's breast. The other female was never found.

All told, seven Virunga mountain gorillas had been killed in less than two months. Brent Stirton's photographs of the dead creatures being carried like royalty by weeping villagers ran in newspapers and magazines around the world. The murders of these intelligent, unassuming animals the park rangers refer to as "our brothers" ignited international outrage.

There was no shortage of suspects. The gorillas share the park with tens of thousands of heavily armed soldiers engaged in a three-way guerrilla war between two rival militias and the Congolese army. The park is also home to poachers and hordes of illegal charcoal producers, and it is bordered by subsistence farmers and vast refugee camps overflowing with families fleeing the bloodshed. Caught in this vortex of human misery, it would be a miracle if the animals remained unscathed. But who would kill gorillas in cold blood, and why?

**BECAUSE OF ITS UNRIVALED** biological and geological diversity, Virunga National Park is the crown jewel of African parks. Founded in 1925, it is the oldest national park in Africa. A narrow strip of resplendent geography covering almost two million acres (slightly smaller than Yellowstone), Virunga is sanctuary to animals as varied as the okapi—imagine a zebra-giraffe combination—the Ruwenzori duiker, wintering Siberian birds, and three taxa of great apes.

“It contains the largest number of mammals, birds, and reptiles and has more endemic species than any other park on the African continent,” says Emmanuel de Merode, director of WildlifeDirect, a nascent Nairobi-based organization founded by conservationist Richard Leakey. De Merode, 37, a biological anthropologist, began working in the Democratic Republic of the Congo (DRC) in 1993 and did his Ph.D. on the illegal bush-meat trade in eastern DRC.

“Virunga also has one of the largest volcano lava lakes and the greatest landscape diversity—alpine forest, moorlands, tropical forest, savanna—between 3,000 and 16,000 feet in the world,” de Merode explains. “The truth is, Virunga is arguably the greatest national park on the planet.”

There are roughly 720 mountain gorillas left on Earth; half live in Uganda’s Bwindi Impenetrable National Park and the other half 15 miles south in the Virunga Mountains. The volcano-studded Virunga range straddles the borders between Rwanda, Uganda, and DRC. Three parks share the Virunga region: Mgahinga Gorilla National Park in Uganda, which has at most a few dozen gorillas; Volcanoes National Park in Rwanda (famous for Dian Fossey’s research), with perhaps 120 gorillas; and Virunga National Park, home to as many as 200.

Mountain gorillas were once a top tourist draw at Virunga National Park and have the potential

---

*Wyoming-based writer Mark Jenkins, who wrote about lowland gorillas in our January issue, has reported from conflict zones around the globe. Award-winning South African photographer Brent Stirton is on staff with Reportage by Getty Images.*

**WE SET OUT ALONG  
THE OMINOUSLY EMPTY  
ROAD BEFORE FINALLY  
BEING WARNED THAT IT  
HAS BEEN MINED. WE WIND  
UP WALKING RIGHT INTO  
THE BARRELS OF NKUNDA’S  
FRONTLINE SOLDIERS.**

to bring in several million dollars a year. This matters because Virunga, like all parks in the DRC, must generate its own income to survive. Virunga is administered by the ICCN—Congolesse Institute for the Conservation of Nature—an organization that functions as an official agency but is barely funded by the national government. (In the U.S., this would be tantamount to having a concessionaire operate the national parks.) Without a guaranteed budget, Congo’s national parks are deeply susceptible to corruption and exploitation—hallmarks of a country Transparency International named as one of the 13 most corrupt nations in 2007. Notably, the wildlife agency was a pet project of former dictator Mobutu Sese Seko, father of the modern African kleptocracy, who actually told his countrymen in one public address, “If you want to steal, steal a little cleverly, in a nice way. Only if you steal so much as to become rich overnight, you will be caught.”

Such leadership has had catastrophic consequences for Virunga. In particular, it set the stage for a calamitous struggle between two men: Honoré Mashagiro, Virunga National Park’s chief warden at the time of the gorilla killings, and Paulin Ngobobo, warden for the southern sector of the park.

Named a World Heritage site by UNESCO in 1979, Virunga National Park has also been a fixture on the UN’s list of the most endangered places. Why? Because, for all its biotic diversity, Virunga also happens to lie at the epicenter of the greatest diversity of man’s inhumanity toward man in recent memory: the 1994 genocide in nearby Rwanda—the killing of more than 800,000 Tutsi people—and two wars in Congo, in 1996-97 and 1998-2003, which left



**Troops loyal to Congolese Tutsi Laurent Nkunda train in the park. They control the Mikeno sector, home to as many as 200 of the world's remaining 720 mountain gorillas. Nkunda's troops say they are under penalty of death if they molest the great apes, the engine of Virunga Park's once profitable tourism.**

over five million people dead, more than any conflict since World War II. Given the scale of devastation, it's a wonder Virunga National Park still exists at all. Credit goes to the ineffable determination of the park's 650 ICCN rangers. In the past decade more than 110 park rangers have been killed in the line of duty—the majority shot not by poachers, but by militias.

After the Rwanda genocide, the perpetrators, largely Hutu fighters and Rwandan soldiers, fled west into the Congo and made alliances with the distempered Congolese army. Over the years, these exiles reorganized themselves into the Democratic Forces for the Liberation

of Rwanda, better known as the FDLR. By seizing and exploiting the region's rich resources—mining gold, tin, and other minerals with forced labor and cutting old-growth forests to produce charcoal—the Hutu militias were able to rearm, indoctrinate a new generation into their ideology of ethnic hatred, and continue to prey on Tutsi, this time in eastern Congo.

In response to the collusion between the Hutu and the Congolese army, a Congolese Tutsi general, Laurent Nkunda, formed his own rebel force, called the National Congress for the People's Defense, or CNDP. Nkunda's soldiers, with tacit support from Rwanda, have been fighting



Rebel general Nkunda, who prefers to be called the "Chairman," wages war against the Congolese army and Hutu militias from a farmhouse near Kirokirwe, just west of Virunga Park. Accused of using child soldiers and other war crimes, Nkunda claims he is protecting the Congolese Tutsi from genocide at the hands of the Hutu. He also claims he is a conservationist.







**A close encounter with a gorilla from the Kabirizi family awes soldiers from Nkunda's forces. Unseen by outsiders for six months while fighting raged, this family seems unharmed. The gorillas are highly susceptible to flu and other human diseases, the reason the park service requires all visitors to keep at least 23 feet away. Nkunda has revived gorilla tourism without park service permission.**

the Hutu forces for years, transmogrifying the southern half of Virunga National Park into a blood-pooled battlefield. The Congolese army, depending on which way the political wind is blowing and which way the money is flowing, sometimes fights with Nkunda's forces, and at other times joins ranks with the FDLR.

All three forces have committed unspeakable atrocities upon the civilian population in the province of North Kivu. Gangs of barely paid soldiers armed with machine guns (grotesquely referred to as the "AK credit card") have taken whatever they want, whenever they want, from whomever they want. Tens of



thousands of women and girls as young as five have been raped, some gang-raped by Congolese or FDLR soldiers and then, when their village was retaken by Nkunda's soldiers, raped again. Scores of innocent people have been tortured, hundreds of civilians shot to death, and more than 800,000 people forced to flee their homes, only to become starving refugees in their own country. North Kivu is a Hieronymus Bosch painting come alive.

**ONE THING SEEMED CERTAIN** from the moment the bodies of the gorillas were found last July: Poachers had not killed them. Poachers who

prey on gorillas leave an unmistakable calling card: They kidnap the infants and cut off the heads and hands of the adults—to be sold on the black market. But these bodies were left to rot where they fell, and the motherless infants left to starve to death.

What about the soldiers swarming in Virunga National Park? When Brent and I arrived this February in Goma, the grim capital of North Kivu only ten miles south of the park, Nkunda had just signed a peace agreement with the Congolese army, but his rebels still controlled Mikenko, the sector of the park inhabited by gorillas. Nkunda's troops are thought to have killed and eaten two mountain gorillas last year. The rebels had not allowed anyone in to see the creatures for six months, and most of the rangers had fled. Naturally we were told it would be impossible to go behind enemy lines. It wasn't, but first we would have to meet the "Chairman," as Nkunda prefers to be called.

Our audience takes place at a hilltop farmhouse near Kirokirwe, just west of the park in Masisi District, much of which Nkunda controls. The general is surrounded by armed bodyguards, but he himself is dressed in a sharp black suit, pressed white shirt, and sunglasses. He looks like a jazz musician, but don't be fooled.

Nkunda's soldiers have been accused of war crimes by Human Rights Watch, and Nkunda himself is "of interest" to the International Criminal Court. He is known for dragooning child soldiers. But he dismisses the charges with a wave of his hand. He tells me that all the incidents in question occurred when his troops and the Congolese army were a coalition force, so he was not in direct control of his soldiers.

"Even if our past was bad," Nkunda says, "I tell my people that we must always focus on the future."

It is evident that Nkunda no longer views himself as a dissident general. He is a politician. When I ask him where he sees himself in the future, he grins knowingly and says, "Kinshasa"—the capital. I query him about the gorillas.

"It is an honor to have them in my country. It is my obligation to protect them."

He says that the Mikeno sector needs the expertise of the Congolese wildlife service. He invites the rangers back with open arms.

"You are welcome also. Go see the gorillas for yourself in Bukima. Tell the world what you find there."

Late that night Brent and I learn that at the very hour when Nkunda was inviting us into his domain, top ICCN rangers, escorted by UN forces, tried to visit the gorilla sector. Nkunda's rebels told the rangers that had they not been escorted by the UN, they would all have been executed on the spot.

The next morning we decide to test Nkunda's offer. Apparently, neither he nor his commanders thought we would go to the trouble, for they fail to tell us they have mined the road to Bukima. Alone and on foot, Brent and I set out across no-man's-land along the ominously empty road before finally being warned. And despite satellite-phone calls to Nkunda's commanders, we wind up walking right into the barrels of his frontline soldiers, none of whom has been told who we are or what we're doing there. Luckily we are captured rather than killed by the rebels, and that night we share warm milk straight from the cow in a smoky dirt bunker and fall asleep to the surreal sound of soldiers singing a cappella in camouflaged trenches.

In the morning, led by seven rangers and two dozen guerrillas armed with AK-47s and RPGs (rocket-propelled grenade launchers), we march into the forest. It takes the trackers two hours to find the gorillas. The alpha male, a silverback named Kabirizi, annoyed by our presence, immediately turns his muscled, piano-size back to the bandoliered guerrillas. Squatting in the mountainous, verdure world of vines, he keeps an eye on his harem, chews leaves, occasionally pivots his huge head and scowls at the soldiers. He is king of his remote kingdom.

The Kabirizi family appears healthy and unmolested. According to Kayitare Shyamba, 45, the lead ranger guiding us, the gorillas are being monitored every day. He says no gorillas have died since the killings last year and that he and his rangers are also monitoring a few

**"THE GUARD REMOVED MY JACKET AND MY BELT AND MY BOOTS AND MADE ME LIE FACEDOWN IN THE MUD. HE COUNTED, ONE, TWO, THREE, AS HE WAS WHIPPING ME."**

— PAULIN NGOBOBO, WARDEN  
SOUTHERN SECTOR, VIRUNGA PARK

other families, one of which has a new baby.

Before being escorted out of Mikeno, I talk to a dozen of Nkunda's foot soldiers. They are at least nominally knowledgeable about and respectful of the animals. One young man who says he's 25 but can't be more than 17 tells me privately that they are under penalty of death not to disturb the gorillas—perversely ironic, given the agonies some of Nkunda's soldiers have perpetrated on innocent humans.

Brent and I manage one other excursion into Nkunda's territory, this time to Bunagana. Once the staging area for cash-flush tourists heading in to see the gorillas, Bunagana is now a bleak, war-ravaged village patrolled by adolescent soldiers stroking their AK-47s. We are met by Pierre Kanamahalagi—"Kana" for short—a former ICCN ranger with a fluorescent green shirt, who installed himself as the new warden of the Mikeno sector when Nkunda took the region. He assigns three rangers to accompany us.

We find a gorilla family just inside the park. The silverback is rolling backward down a hillside, like a gigantic bowling ball. Two young males are wrestling with each other; a female, nibbling on leaves, is tucked into the foliage away from the ruckus. These gorillas, too, are safe. We learn that this is a family that has crossed into the park from Uganda; what's more, tourists from Uganda, the first in more than six months, will be arriving in just three hours.

"All of the gorillas in the park are now safe and healthy," Kana says triumphantly when we return to Bunagana. He claims to have 32 rangers working under him. When Nkunda routed Congolese and Hutu forces from Mikeno, he says, the wildlife service removed all the other rangers—"It was a political act." The rangers he

has left were those brave enough to stay and protect the gorillas.

Rangers outside Nkunda's territory had told me a different story. They said that rebels ransacked their patrol posts, stole their uniforms, boots, rifles, and GPS's, and gave rangers the option of joining Nkunda's forces or running for their lives. One ranger I spoke with, accused of collaborating with Congolese forces, was bayoneted through the hand, beaten with clubs, then thrown into a pit with 12 other accused civilians. Each day, he said, three prisoners were dragged from the pit and beheaded. After four days, the ranger was the only one left. His life was spared because a rebel suggested he might make a good tracker in the jungle.

When I relay all this to Kana, he objects. He tells me the rangers I interviewed are liars. "The ICCN is corrupt," he says. "They were taking money from gorilla tourists and putting it into their own pockets. All the top ICCN officials in Virunga must go to jail."

Kana acknowledges that he has restarted gorilla tourism without the sanction of the ICCN. The agency has stopped paying the salaries of the rangers, and he needs the money to pay them. Kana says he wants to work with NGOs that have gorilla experts, like the International Gorilla Conservation Program, which is already providing rations to his rangers. He insists that Nkunda's soldiers have all been "sensitized about the mountain gorillas," and that his rangers are doing a far better job protecting them than the wildlife agency ever did. He then intimates something I'd heard when interviewing the ousted rangers myself.

"Who killed those gorillas last July?" Kana challenges me. "Who? Ask anyone. It was not soldiers."

I try to remind myself that not everything a dishonest man says is a lie.

**"FOLLOW THE TRAIL** of charcoal," de Merode had said at the WildlifeDirect office. "Charcoal is the biggest threat to the park."

Charcoal, as we discover over the next few days, is the main source of energy, and evil, in

North Kivu. Charcoal is used by 98 percent of the households for cooking, boiling water to make it potable, and also for heat. In the city of Goma, a constant pall of charcoal smoke smudges out the sun and makes the rough streets, rumped with hardened lava from the 2002 eruption of Nyiragongo, appear to be pathways to hell.

Bound by Lake Kivu to the south, Goma is a tin-roofed shantytown that in the past decade has swelled with people fleeing conflict. Its population now stands at roughly 700,000, with several hundred thousand more in nearby refugee camps. The UN has a force of 5,700 mostly Indian soldiers garrisoned in and around the city. Their headquarters, like most of the office buildings and homes of NGOs, is a miniature fortress—armed guards, metal gates, 12-foot-high concrete walls strung with razor wire.

Because of the fertile, volcanic soil, the area around the park is one of the most densely populated regions in Africa, with more than a thousand people per square mile. Neatly hand-hoed fields of potatoes, cassavas, bananas, and beans run right up to the park boundaries. There is no buffer zone between human activity and the verdant hysteria of the forest, just a rock wall buried beneath foliage. Charcoal, made from trees cut and reduced to carbon in makeshift mud ovens, comes from inside the park.

The most valuable, old-growth trees are the source of hardwood charcoal, which burns hotter and longer than softwood charcoal. To try to save the forests, NGOs like the World Wildlife Fund have planted millions of trees, especially fast-growing eucalyptus, around the park as a sustainable source of wood. Experts are also looking to more efficient stoves and other fuels, such as butane, leaves, grass, and even sawdust. But for now, the illegal charcoal business is thriving.

One 150-pound sack of hardwood charcoal lasts the average family about a month. With more than 100,000 families living within 20 miles of the southern end of Virunga National Park, the demand amounts to 3,500 to 4,000 sacks of charcoal (Continued on page 58)

# VIRUNGA: GORILLAS IN A WAR ZONE

The region supports a wealth of animal and plant species, but also one of the densest human populations in Africa: more than a thousand people per square mile. Conflicts over resources and land erupt in and around the park as militias, charcoal poachers, refugees, and political leaders vie for control—or simple survival.

## CAUGHT IN THE CONFLICT

**Mountain Gorillas**  
More than half the world's remaining population. Gorillas need dense vegetation for food (individuals eat up to 60 pounds a day) and ground nests. **380 in Virunga and adjacent parks**

**ICCN Rangers**  
Members of the Congolese park service (ICCN) charged with protecting Virunga Park and the gorillas; often supported by conservation NGOs. **650 rangers in Virunga Park**

**IDPs/Refugees**  
Civilians fleeing violence, crowded into camps for internally displaced persons (IDPs). More people have died in the Democratic Republic of the Congo—5.4 million—than in any conflict since World War II. **800,000 refugees in or near Goma**

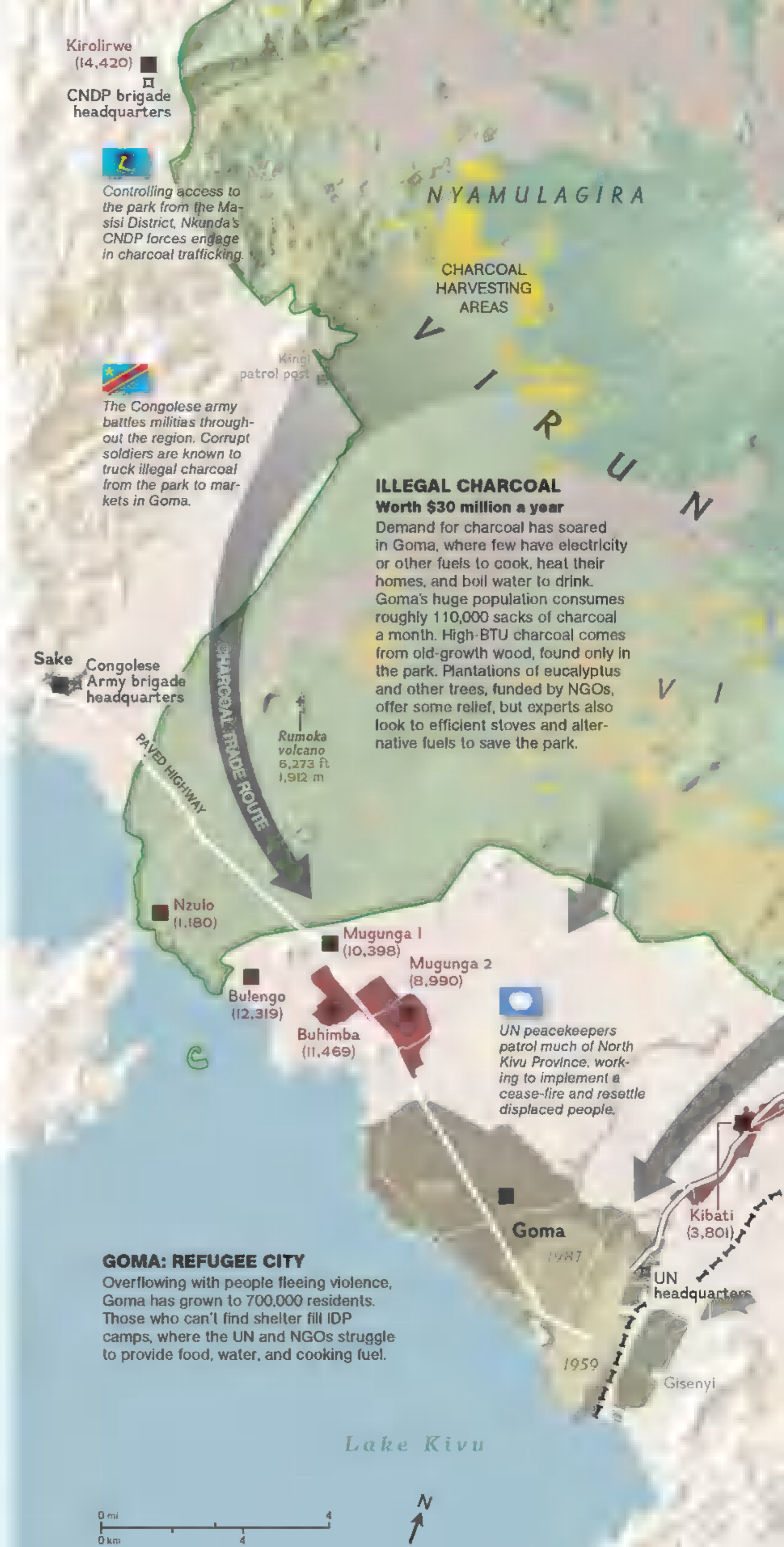
**UN Peacekeepers**  
In its largest and most expensive peacekeeping mission, the UN seeks to help DRC protect civilians and restore state authority. **5,700 troops in North Kivu Province**

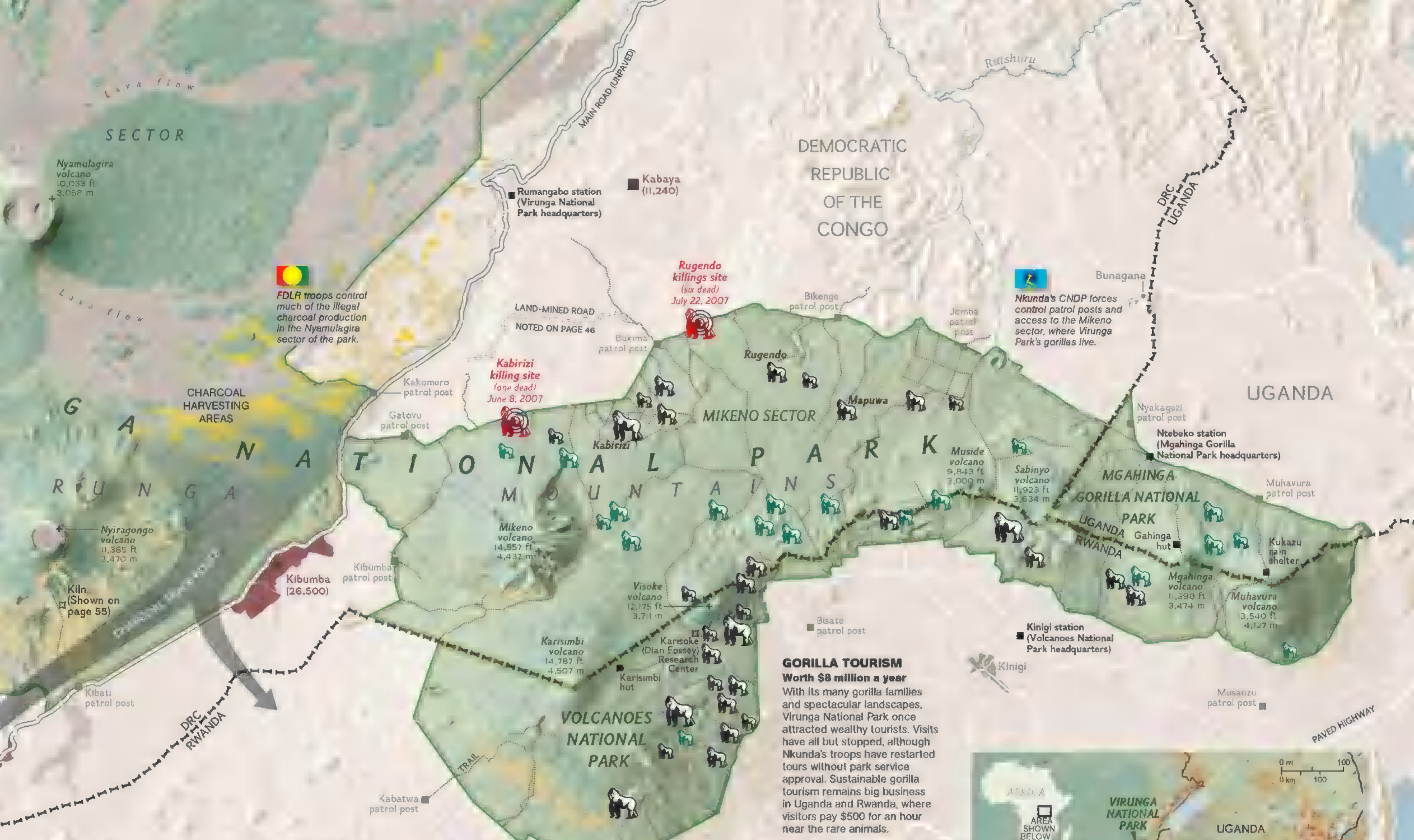
## WARRING GROUPS

**Congolese Army**  
While the national army—the Armed Forces of the Democratic Republic of the Congo (FARDC)—strives to maintain order, corrupt soldiers in its ranks traffic in drugs, minerals, and charcoal. Often allied with Hutu militias (FDLR). **15,000 soldiers in the region**

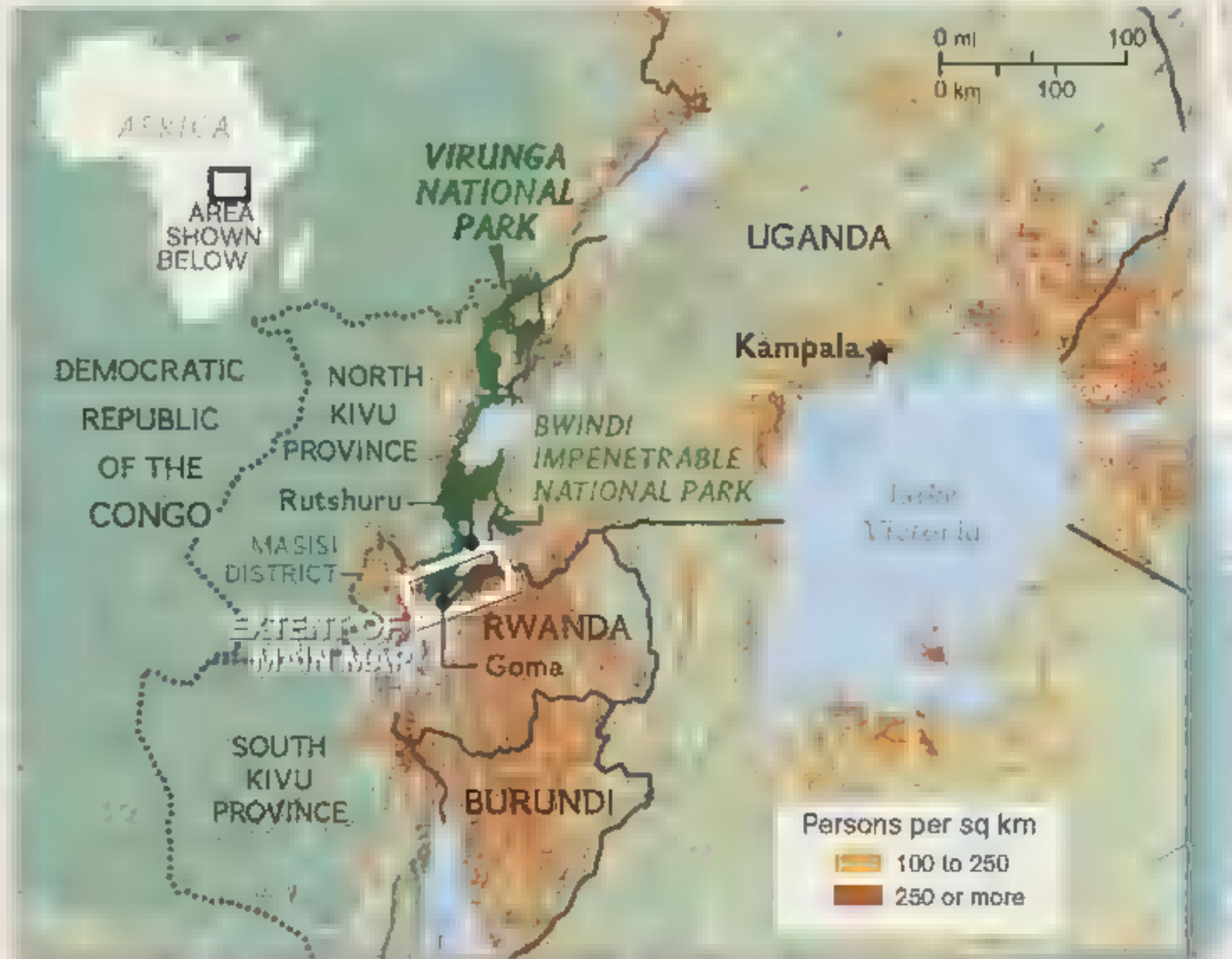
**CNDP**  
Tutsi militia led by Laurent Nkunda, the National Congress for the People's Defense (CNDP) controls grazing lands, trade routes—and the gorilla sector of Virunga Park. **4,000 soldiers in the region**

**FDLR**  
Hutu militias formed by Rwandan rebels who fled into Congo and reorganized as the Democratic Forces for the Liberation of Rwanda (FDLR); involved in illegal mining, drug trafficking, and harvesting charcoal inside Virunga Park. **4,000 soldiers in the region**





**GORILLA TOURISM**  
**Worth \$8 million a year**  
 With its many gorilla families and spectacular landscapes, Virunga National Park once attracted wealthy tourists. Visits have all but stopped, although Nkunda's troops have restarted tours without park service approval. Sustainable gorilla tourism remains big business in Uganda and Rwanda, where visitors pay \$500 for an hour near the rare animals.



- Gorilla groups**
  - Greater than 16
  - 2 to 16
  - Lone silver-back
  - Unhabituated groups shown in green
- Deforestation**
  - Recent 2003-2006
  - Older 1987-2003
- IDP/Refugee camps**
  - (Number of displaced persons as of early 2008, where available)

MARTIN GAMACHE AND LISA R. RITTER, NG STAFF  
 SOURCES: AFRICAN WILDLIFE FOUNDATION; CENTRAL AFRICAN REGIONAL PROGRAM FOR THE ENVIRONMENT; CONGOLESE INSTITUTE FOR THE CONSERVATION OF NATURE (ICCN); DIAN FOSSEY GORILLA FUND INTERNATIONAL; FRANKFURT ZOOLOGICAL SOCIETY; INTERNATIONAL GORILLA CONSERVATION PROGRAM; INTERNATIONAL PEACE INFORMATION SERVICE; GEOGRAPHIC INFORMATION SCIENCE CENTER OF EXCELLENCE, SOUTH DAKOTA STATE UNIVERSITY; OAK RIDGE NATIONAL LABORATORY LANDSCAN 2006; WWF-EARPO; UNITED NATIONS



**STRUGGLING TO SURVIVE** Despite the rich volcanic soil that nurtures bean and potato fields pressing in on Virunga National Park (following page), some people go hungry in densely populated North Kivu Province. Forced from their homes by a decade of war, hundreds of thousands of people find shelter in Goma, or in disease-prone camps like Kibumba (below). The search for fuel to cook or boil water for drinking drives villagers into the park to cut trees illegally; rangers confiscate one woman's load (above).











**THE CHARCOAL TRADE** Where there's smoke in Virunga Park there's an illegal charcoal kiln, like one near Kibati being dismantled by rangers backed by UN troops (above). The hardwood baking in this dirt mound would have produced perhaps a hundred sacks of charcoal, carried out by caravans of porters (left) to trucks escorted by corrupt Congolese soldiers. A ranger (below) detains a girl bearing a 150-pound sack. Stopping "mule trains" and the \$30-million-a-year trade they enable is a ranger's most dangerous mission.





Her sack of charcoal confiscated, a woman begs a park ranger for mercy. Most "mules" are women from the refugee camps or villeges, hired for less than a dollar a day. This woman will likely get a warning and a lecture. It's hard to fine people who have nothing.



(Continued from page 47) a day, and this does not include the needs of Rwanda, which has outlawed the production of charcoal to protect its forests.

This much charcoal cannot be transported without a fleet of trucks. The Congolese army has the trucks, and it has suppliers in the forest: the Hutu militias. A sack of charcoal sells for \$25 on average. Do the math: De Merode estimates that in 2006, when gorilla tourism brought in less than \$300,000, the Virunga charcoal trade was worth more than \$30 million.

Robert Muir, project manager for the Frankfurt Zoological Society's Virunga National Park conservation effort, says that charcoal production has already devastated approximately 25 percent of the old-growth, hardwood forest in the southern half of Virunga National Park, and at the current rate of destruction, the entire southern sector could go up in smoke in ten years.

"But it can be stopped, it must be stopped, and it will be stopped," he says.

Muir, an Englishman who speaks fluent French (as did his mother), who has the guts of a gunner (his father was a colonel in the British military), whose first language was Cantonese, who passed his youth in Cyprus chasing butterflies and scorpions, who holds university degrees in ecology and anthropology, has been in Goma for four years. He spent the first three years trying to protect Virunga's rangers. Now he has turned his considerable passion to the charcoal trade. Just outside his office are 50 sacks of charcoal that he personally helped the rangers seize.

Muir explains the challenge: Nkunda's forces won't leave Virunga National Park until the Hutu guerrillas leave, and the Congolese army won't leave until they're both out. It's a stalemate no one really wants to end. Not when there's so much money to be made off charcoal. (Nkunda claims he has banned all tree felling in his regions of control. While that may be true for the Mikeno sector, he has reportedly taken over charcoal operations near Kiorolirwe.) And if the charcoal production isn't stopped, the forest will



be gone: no habitat, no gorillas. Muir understands that the removal of all military from the area—perhaps 15,000 Congolese soldiers, 4,000 Hutu (FDLR) guerrillas, and 4,000 Nkunda (CNDP) troops—is the ultimate answer, but given politics in Congo, the park itself could be gone by then.

"Nothing happens in meetings," Muir says. "You want to get something done, you go into the field. The FDLR has been controlling the forests, making charcoal, at the base of Nyiragongo. For six months no one has been able to get in there. The UN has agreed to lead a combat patrol. You're welcome to come along."



**WE HIKE IN THE NEXT MORNING.** Our force numbers almost 50, including 12 rangers and Muir. At its core are 18 Sikhs, all veteran fighters, commanded by Maj. Shalendra Puri. UN soldiers are typically called “blue helmets,” but in this case they are the blue turbans. Hiking 11,385-foot Nyiragongo was once another major source of income for Virunga National Park. Tourists paid \$175 to hike to the top, gaze into the abyss, and camp on the rim. The treks were halted in mid-2007 when the Hutu militias increased charcoal production. The rangers attempted to thwart the guerrillas several times, most recently two weeks ago,

Rangers at the Kibati patrol post seize charcoal hidden under a load of vegetables and bamboo. Many of the trucks are escorted by armed soldiers prepared to shoot their way through checkpoints, but UN forces supported the rangers making this bust. Confiscated charcoal is distributed to refugee camps and orphanages.

but were turned around by machine-gun fire.

Our column snakes up through jungle interspersed with open slopes of ropy black lava that burned through the forest during the 2002 eruption. It is raining, but the presence of the disciplined Sikhs quickens the hearts of the rangers. This is an emancipatory patrol, and they are inspired for the first time in months.

At the point where the rangers were forced to retreat last time, we come upon a bamboo cross—a warning. Major Puri is unimpressed. He instructs his Sikhs to fan out and move up the hill. They do so methodically, communicating via hand signals, fingers on their triggers. Major Puri has his sidearm drawn.

We can see blue smoke curling into the sky ahead. Major Puri directs five soldiers to investigate. Minutes later, some distance above us, we spot four armed Hutu rebels running across the talus. Another hundred yards uphill, and three more disappear into the jungle.

Not a shot is fired. After the Sikhs secure the area, Major Puri allows us to follow the footpath toward the smoke. We pass through a line of trees and enter a clear-cut several acres in size. In the middle is a smoldering dirt mound.

“My God, it’s enormous,” breathes Muir.

Perhaps 20 feet in diameter and 15 feet tall, packed with dirt on all sides, it looks like a smoking volcano itself.

“This is a charcoal kiln,” says Muir exuberantly, “and this is the first charcoal kiln bust for a long, long time.”

Muir explains that the oven is loaded with old-growth hardwood but fueled with soft woods. This kiln would have produced 50 to 100 sacks of charcoal. Muir calls in the rangers, who attack the kiln with years of pent-up frustration, tearing it apart with sticks and shovels.

The rest of the hike is a breeze. Everyone is in high spirits. The Sikhs have accomplished their mission, and the rangers have, at least for the moment, regained some measure of self-respect.

We reach the rim by dusk and erect our tents, then stand on the edge and stare down into the crater. Far below, as if we were looking

into Hades itself, is a circular pool of boiling, orange stone. The lava lake spurts and bubbles, appears to harden into a black carapace, then fractures and is swallowed anew by explosions of molten lava—a constant, mesmerizing metamorphosis.

That night in a torrential thunderstorm, Major Puri and Robert Muir squeeze into our two-man tent for a celebratory dinner. Muir pulls two bottles of champagne from his raincoat. Buzzing from the success of the bust, he shoots the top off the first bottle.

“This is just the first step. The charcoal mafia can be stopped! We can do it together.”

**AT THE KIBATI PATROL POST** at the southern entrance to the park, a dozen armed rangers man a checkpoint, searching for illegal charcoal. The ubiquitous white NGO Land Cruisers, the UN peacekeepers in armored trucks, and the *matatus*—Toyota Hiace vans loaded with as many as two dozen people—are quickly waved through the roadblock, which consists of nothing more than a bamboo pole across the road. Trucks are what the rangers stop and search—“about 20 vehicles a day,” says John Iyamorenje, 35, a well-spoken ranger. “Two to four of those are carrying large loads of charcoal.”

His uniform is ragged and his boots split. I notice that the barrel of his rifle is rusted shut.

“We only get \$30 a month,” Iyamorenje says, responding to my unspoken observations, “and this is paid by NGOs, not by the government. We don’t have radios, we don’t have support from the ICCN, we don’t have enough money to feed our families.”

Another truck is stopped. Congolese soldiers recline as languorously as cats on top of the load. They start shouting and leap to the ground, pointing their machine guns at the rangers. Undaunted, the rangers haul themselves up onto the truck and discover sacks of charcoal hidden beneath a layer of firewood. The soldiers wave their machine guns and scream at the rangers to get down.

Unbelievably, the rangers ignore the threats. They begin rolling the heavy sacks off the



truck, the bags bursting open when they hit the ground. Nearby waits the serendipitous source of their courage: a UN vehicle with a dozen well-armed, flak-jacketed Sikh soldiers.

“Usually we can never stop the Congolese military,” says Iyamorenye. “They,” he nods imperceptibly at the incensed Congolese soldiers, “they may kill us.”

In operations like this, the rangers have captured more than a thousand sacks to date, handing them over to the UN to help support the refugees. But the seizures have hardly altered the trade. That night, right after dark, a convoy of four military trucks loaded to the gills with charcoal blasts straight through the roadblock.

**BACK IN GOMA,** Muir confirms what Brent and I had begun to suspect. “It was the battle over charcoal that provoked the gorilla killings last year. It was all about one incorruptible ranger, Paulin Ngobobo. You need to talk to Paulin. He’s the real hero. He’s the man that risked his life to try and save this park.”

Paulin Ngobobo is in Kinshasa; last July the wildlife agency removed him from the park for his own protection. Muir arranges for him to be flown quietly into town. Several days later, in the deep of the night at an undisclosed location, I meet Ngobobo. We sit in plastic chairs beside stygian Lake Kivu. A candle on the table flickers light on him. His visage is a chiaroscuro portrait of anguish, his eyes so creased he appears much older than his 45 years.

Ngobobo insists on starting the story at the very beginning. He speaks in French, his voice so soft I can hardly hear it above the lapping of the water.

Before becoming the ICCN warden for the southern sector of Virunga National Park, Ngobobo explains, he had 20 years of conservation experience. He’d worked as the program officer of the International Gorilla Conservation Program. Before that he’d run his own NGO for a decade, teaching Pygmies how to become self-sufficient farmers rather than poachers.

When he became the sector warden in May 2006, he launched internal investigations into

**ONE RANGER, ACCUSED OF COLLABORATING WITH CONGOLESE FORCES, WAS THROWN INTO A PIT WITH TWELVE OTHER CIVILIANS. EACH DAY, HE SAID, THREE PRISONERS WERE DRAGGED OUT AND BEHEADED.**

the illegal charcoal trade and quickly discovered that practically everyone, top to bottom, was on the take. The Hutu militia, the Congolese army, the village chiefs, even his rangers. Upper level ICCN officials were skimming income from gorilla tourism. In extreme cases, they would report having 20 gorilla tourists—at \$300 a person—when the real number was 200, pocketing a cool \$54,000.

Ngobobo speaks with a kind of sorrowful exactitude. Like a clean cop who was put in charge of a rotten-to-the-core precinct, he explains everything in detail—names, numbers, dates.

By rotating out a few embezzlers, Ngobobo says, he was able to restore the rangers’ salaries, which were also being skimmed by their bosses, making it easier for them to resist the paltry five dollars a month the charcoal mafia would pay them to look the other way. This gradually restored their sense of duty and pride, and he began personally leading charcoal busts.

I had spent the previous two days in the park headquarters, Rumangabo, interviewing rangers and their families. They were intimately aware of the impact of Ngobobo’s war on charcoal.

“This was extremely dangerous work,” Marie Therese Nsangira, 53, said one dreary afternoon. She has nine children and no shoes. Her husband was one of the inspectors responsible for interdicting charcoal trafficking.

“He was on his way to work one morning when his matatu was stopped. He was dragged from the vehicle by soldiers and shot dead with his own rifle.”

Aza Ayubu, 27, the wife of a Rumangabo ranger named Iyomi Imboyo, had her own horrifying tale. She was riding on the top of a



**Fellow park rangers bury Kambale Kalibumba, a 36-year-old father of eight who was shot on February 27 while trying to apprehend a Congolese soldier. The soldier had allegedly murdered a doctor to steal his motorbike. In the past decade more than 110 Virunga Park rangers have been killed in the line of duty.**

truck on the way back from the market when soldiers attacked it. Her right leg was practically blown off by bullets. She doesn't know if the soldiers wanted to use the truck for charcoal smuggling, or whether the attack was in retaliation against the anti-charcoal campaign.

"I even don't know which soldiers did this," she says, pointing to her leg. "They change uniforms before they do these things."

**BY THE FALL OF 2006**, Ngobobo's campaign against the charcoal poachers was beginning to gain traction. Then, out on patrol, he and seven rangers were attacked by Congolese and FDLR

soldiers. Ngobobo and his rangers hid in the forest until late into the night, then escaped. The following morning he went directly to the colonel at the military camp in Rutshuru to lodge a complaint.

"That was the beginning of the end," Goma-based attorney Matthieu Cingoro told me. Cingoro, 52, is a clean-cut gentleman who has the quiet dignity of someone with enormous responsibility. After the gorilla killings, UNESCO and the World Conservation Union (IUCN) started an investigation, which, though never made public, created pressure on the ICCN to instigate its own investigation. The wildlife

**IN TRYING TO STOP THE CHARCOAL POACHING, NGOBOBO HAD COME TO BELIEVE THAT HIS OWN BOSS, THE CHIEF WARDEN OF VIRUNGA NATIONAL PARK, WAS THE KINGPIN OF THE CHARCOAL TRADE.**

agency hired Cingoro and his firm to pursue the case, and he has been working it ever since.

“Paulin, one man, was now going up against a system of corruption that has existed in the Congo for 50 years. Naturally, he was immediately arrested. It is very dangerous to be a principled man in the Congo.”

Faint starlight is bouncing off Lake Kivu. It is after midnight when Ngobobo recounts what happened.

“It was raining. The colonel’s bodyguard took me outside and stripped me. The colonel had spoken to Honoré Mashagiro, and Mashagiro had said that I was undisciplined and needed correction and I must be given 75 lashes.”

In the course of trying to stop the charcoal poaching, Ngobobo had come to believe that his own boss, the chief warden of Virunga National Park and the ICCN provincial director for North Kivu, was the kingpin of the charcoal trade. He had uncovered cooked books, faked records, protection schemes, payoffs, and charcoal “taxes.” Cingoro says the evidence showed that Mashagiro had been earning hundreds of thousands of dollars a year from the trade.

“The guard removed my jacket and my belt and my boots and made me lie facedown in the mud,” says Ngobobo. “He counted, one, two, three, as he was whipping me.”

As he speaks, I search Ngobobo’s face, but he is too stoic to allow more than a wince, as though he can still feel the whip. He says his scars have healed, but not his psychic wounds.

“Anyone that is a victim of violence, all they ever want is justice. The worst part for me was that my beating had actually been ordered by my superior.”

A leading ICCN officer who spoke only

on condition that he not be named, confirms Ngobobo’s account. “The provincial director was doing everything possible to try and disrupt the investigation and have Paulin removed from Rumangabo.”

But it didn’t work. Ngobobo went right back to dismantling the charcoal network. In June 2007 Ngobobo arrested six top rangers for participating in charcoal trafficking, but Mashagiro overruled the arrest and reinstated the rangers. On June 8 a female gorilla from the Kabirizi family was executed.

“I immediately began an investigation into the killing,” Ngobobo says, slowly shaking his head. “I identified one of the six rangers I had arrested as the likely suspect. However, my investigations were prematurely terminated.”

Mashagiro canceled Ngobobo’s investigations. According to Ngobobo and sources within the conservation community, he also accused Ngobobo himself of killing the gorillas and prevailed upon the North Kivu governor to have him arrested.

“When rangers on patrol could not arrest people directly involved in the charcoal trade, it was because Mashagiro himself was protecting them,” says a field officer with WildlifeDirect.

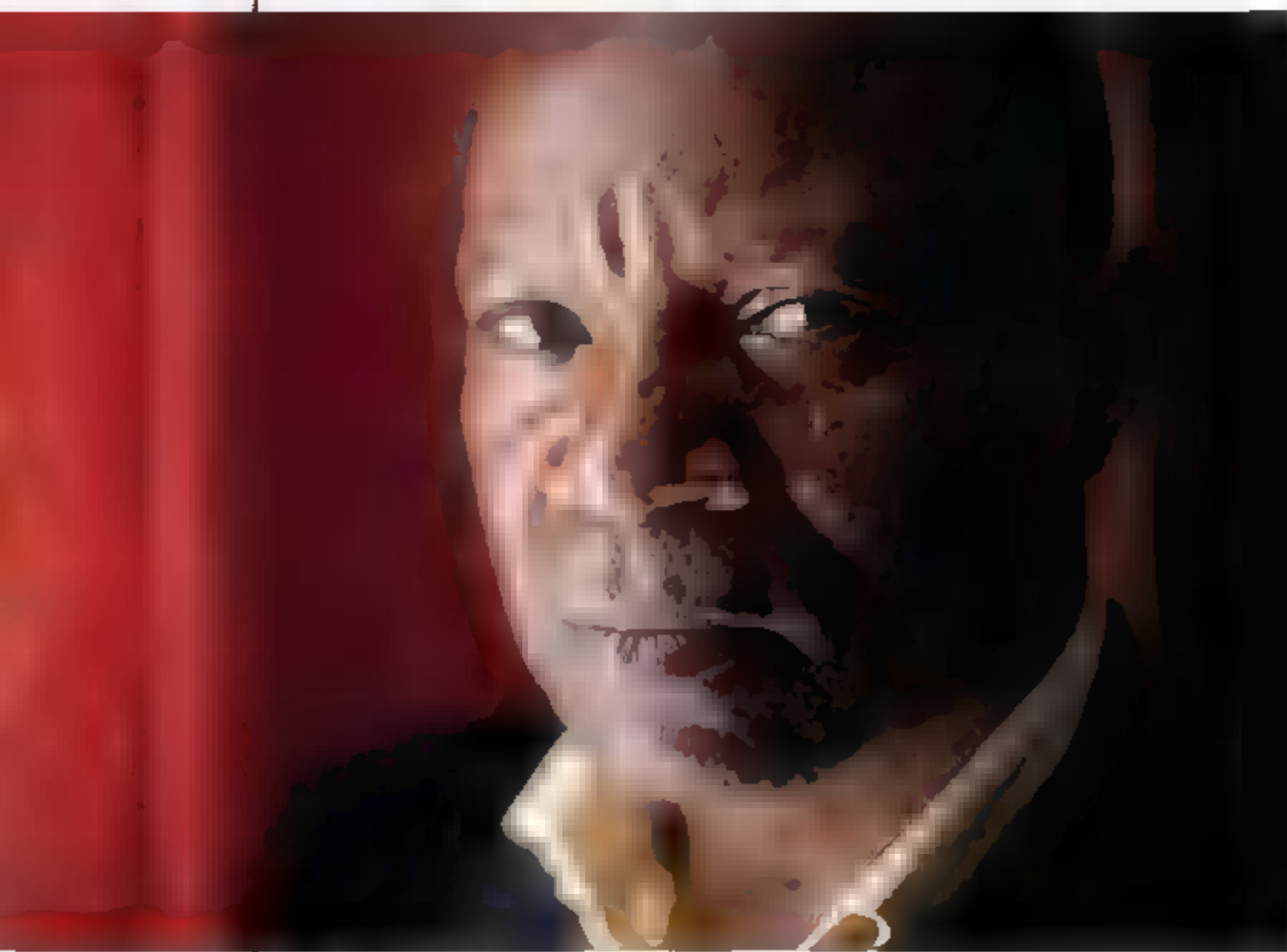
“I was thrown into prison in Goma for one night and one day,” Ngobobo says. “After that, I was allowed to go home at night, but had to go to prison every day and stay until dark without moving, without talking.”

The second night Ngobobo was allowed to go home was July 22. The next morning, the first of the six gorillas was found dead.

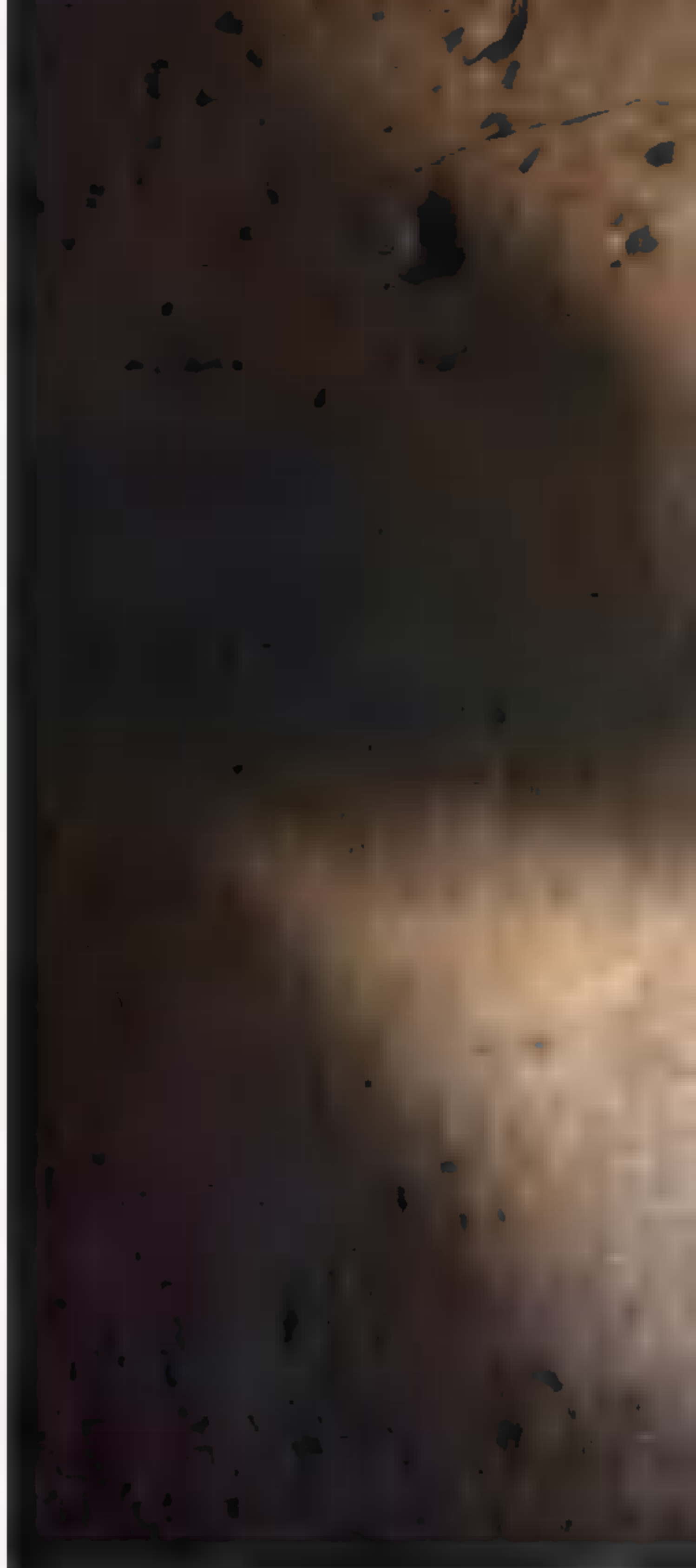
“Mashagiro had the gorillas killed to discredit Paulin,” says a conservation researcher familiar with the case, who requested anonymity out of fear for his life. “This wouldn’t have been difficult. You can have someone killed for a crate of beer in Congo.”

Ngobobo says that three attempts have been made on his life, but—with the help of four bodyguards and the support of local police and military officers—he has escaped injury so far.

Matthieu Cingoro laid out the charges against Mashagiro in a complaint filed March 10 on



**Arrested** ■ **March for trafficking in charcoal, former chief park warden Honoré Mashagiro (above) awaits his day in court. He was also charged with plotting the murder of gorillas to silence Paulin Ngobobo (right), who fought to stop charcoal poachers. Ngobobo cradles the skull of Macibiri, one of the seven gorillas he was falsely accused of killing. With support from international NGOs, Congo's park service is renewing its efforts to save Virunga's peerless ecosystem.**



behalf of the ICCN to the prosecutor general of the Court of Appeals of North Kivu Province, in Goma. The complaint specifically alleges that Mashagiro ran an illegal charcoal network, intimidated Ngobobo and other rangers, and met with six rangers to plan the gorilla murders in order to undermine Ngobobo's standing in the community and ultimately remove him from the park service.

Ngobobo is clearly exhausted. He has flown across Africa to tell me his story. It is two in the morning. He speaks slowly.

"Everyone knew I was innocent, but Mashagiro blamed the killings on me. He had to remove

me to continue his charcoal industry."

Honoré Mashagiro, interviewed by phone, has denied all accusations of misconduct and maintains he was "not in the charcoal business. My business was to protect the park." He also denied having any role in the killings of the gorillas. Although he was the park director, he says, "the gorillas were not my responsibility; they were Paulin's responsibility."

Within a week of the July killings Brent's pictures of the murdered gorillas were splashed across the globe. Mashagiro was removed as provincial director of North Kivu. Ngobobo was transferred to Kinshasa and exonerated of any



wrongdoing. Two villagers were found guilty for their involvement in the gorilla murders and given eight-month sentences.

“It is difficult to know who pulled the trigger,” attorney Cingoro had told me before I met with Ngobobo, “but Mashagiyo orchestrated the killing of the gorillas. That is ■ fact.”

**IN THE PAST TWO MONTHS,** Robert Muir has received ■ promise from General Mayala, the commander of the Congolese army in Virunga Park, that charcoal carried on military trucks will be seized and anyone in the military caught trafficking in charcoal will be imprisoned for 15

days. Muir also persuaded UN commanders to step up joint charcoal patrols with rangers to two to three a week.

Laurent Nkunda and his forces still control the gorilla sector of Virunga National Park. Paulin Ngobobo is waiting for a position as a park warden somewhere in the Congo. And Honoré Mashagiyo—suspended by ICCN—has been arrested in Goma and is awaiting trial for the killing of Virunga’s gorillas. □

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🔪 **Charcoal Wars** Get the latest news from imperiled Virunga National Park and watch a video to learn how to help endangered mountain gorillas at [ngm.com](http://ngm.com).





# ALTIPLANO

WHERE BOLIVIA MEETS THE SKY



PHOTOGRAPHS BY GEORGE STEINMETZ







The cloud-scraping plateau of the Andes is an otherworldly realm where flamingos lift off from a lagoon warmed by hot springs and colored carnelian by algae (above), where wind erodes rock into a modernist shape perched on a narrow base (left), and vehicles seem to float on a shimmering salt flat flooded by summer rains (previous pages).



Moonlight bathes Incahuasi Island, an outcropping of cacti and fossilized algae in the Uyuni salt flat. A great lake covered this



area 16,000 years ago. When it dried up, it left a 4,000-square-mile basin of salt, the world's largest such deposit.

**T**he Altiplano, or high plain, of South America is a place of superlatives: It holds the world's highest navigable lake, Titicaca, and the largest salt flat, Salar de Uyuni. It is the second largest mountain plateau in the world, after that of Tibet—a landscape of ice and fire, wind and salt that stretches from northern Argentina to the harsh flatlands of Peru. Higher than many peaks in the Rockies, the Altiplano formed when an earthshaking collision

between the Pacific Ocean floor and the South American mainland heaved up two Andean ridges flanking a mostly flat, high basin. Toward the southern rim of the Altiplano, where Bolivia, Chile, and Argentina meet, lava burbles in tall, jagged volcanoes; at their feet, on the shores of what was once a vast lake filling the basin, baby mud volcanoes erupt and hiss through the frozen soil. Perhaps nowhere on Earth does a landscape remind us so vividly that there was a time before human time. From a 4x4 racing across the Uyuni—that blinding mirror of salt—time drops away, and when a glittering moon rises directly across from the setting sun on this white plain, eternity seems very near.

Few trees survive in the wind-sheared expanses, and few crops can be coaxed out of the ground. But this echoing landscape is inhabited—by chinchillas and delicately hooved vicuñas, alpacas, and llamas, by inquisitive foxes and, improbably, by large groups of flamingos, which find the exposed, barren expanses of the region's salt lakes a delightful place to breed. Humans live here too, in the millions, most in the wide expanse between Uyuni and Titicaca—an area known in the time of the Inca Empire as the Qullasuyu, the southeastern quarter. After independence from Spain in 1825, a new country—named for the liberator Simón Bolívar—was formed, encompassing most of the Altiplano.

The intense geologic activity beneath the

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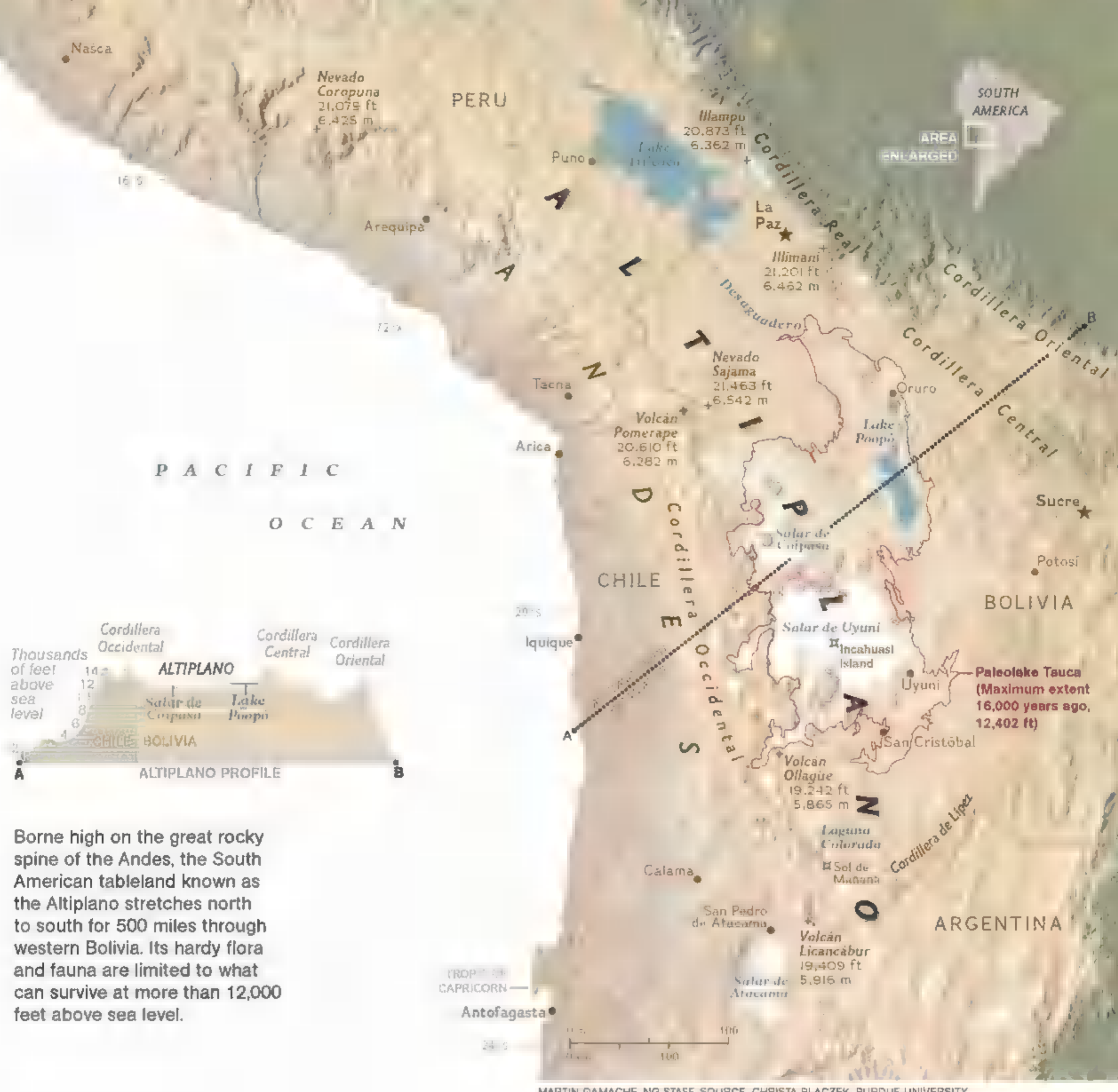
*Alma Guillermoprieto has reported on Latin America for nearly three decades. George Steinmetz used a motorized paraglider to photograph these landscapes.*

Altiplano has endowed Bolivia with extraordinary mineral riches. Silver ore extracted from a single mountain at legendary Potosí helped finance the Spanish crown for centuries and, some economists argue, created the wealth without which Europe's rise to power couldn't have happened. In the early 20th century, tin from newer mines provided the raw material for much of the world's canning industry, making it possible to keep young men in the trenches of World War I for years on end.

The Altiplano is still a source of wealth. After nearly a decade of building up the necessary infrastructure, Apex Silver Mines, a U.S. corporation, is preparing to take ore from another hill, San Cristóbal, which appears to consist almost entirely of silver, zinc, and lead. And another U.S.-owned mine, San Bartolomé at Potosí, may be the world's largest source of pure silver.

Yet in the midst of all these riches—which also flow from plentiful deposits of oil and natural gas in Bolivia's lowlands—the country's per capita income is only about \$3,200 a year. Immense wealth and immense poverty have challenged—and defeated—even Bolivia's few enlightened rulers, as well as persistent efforts by international goodwill organizations. Few countries can match Bolivia's disheartening history of dictatorships, coups, and purely venal rule. One former dictator, Gen. Luis García Meza Tejada, is still in jail for political murders and corruption, and three presidents between 2003 and 2006 did not serve full terms of office.

A casual observer would say that nearly



Borne high on the great rocky spine of the Andes, the South American tableland known as the Altiplano stretches north to south for 500 miles through western Bolivia. Its hardy flora and fauna are limited to what can survive at more than 12,000 feet above sea level.

all Bolivians are brown skinned and most are poor, while a smattering of people at the top of the social heap are well-off and white. But racial distinctions are never so simple. The more potent divide may be the one between the half of the population that speaks only Spanish and the remainder, the indigenous inhabitants of Bolivia, who speak one of the country's 36 other official languages—including Aymara and Quechua, the majority languages of the Altiplano—and often also speak Spanish.

Bolivia today is undergoing profound change, and those bringing it about are the very people whom various forms of despotism have kept in a state of paralyzed submission for centuries.

Marching for their rights, challenging authority, exploding with rage often enough, the descendants of the first peoples are trying to make a new world for themselves—one in which they will occupy the center. The year 2005 saw their greatest triumph: Voting as a block, they elected Evo Morales, an Aymara from the Altiplano, to the presidency. What comes next is anybody's guess, but it will almost certainly not be a return to submission.

—Alma Guillermoprieto

➤ **Andean Guide** See more Altiplano photos by George Steinmetz and an interactive map keyed to these scenes at [ngm.com](http://ngm.com).



Winter's relentless sun vaporizes snow to create spiky forms called *nieves penitentes* near the top of Pomerape Volcano,



at 20,000 feet. Snow falls lightly at such extreme altitudes in the cold, dry climate along the Bolivia-Chile border.



Reflecting the color of the sky, scalding mud pots spatter, hiss, and belch steam stinking of sulfur at Sol de Mañana,







The paisley swirls of a wild grass called *paja brava* pattern the Altiplano beneath rare thunderclouds. Few other plants can



survive the extremes of this windswept region, where some spots get only ten inches of rain a year.



To find new grazing, vicuñas dash across a corner of the Uyuni salt flat. Just three feet tall, these animals produce wool so





The shadow of Sajama—at 21,463 feet, Bolivia's highest peak—juts over the rugged Chilean coast. Bolivia lost access to the





Domesticated llamas spread across a spring-fed pasture at the edge of the Uyuni salt flat. Such creatures have provided





**AFTER 500 YEARS,  
INDIGENOUS PEOPLE  
RETURN TO POWER  
IN A RESTLESS LAND.**

# BOLIVIA'S NEW ORDER

**BY ALMA GUILLERMOPRIETO PHOTOGRAPHS BY GEORGE STEINMETZ**





Voters in native communities like Aymaravi made history in 2005 by electing one of their own as president.

**T**hree years ago in Villa Tunari, a shabby little tropical town at the center of Bolivia's province of Chapare, the source and power of the ethnic revolution taking place in this Andean nation was on full view. Flood rains had churned up rivers, destroyed bridges, provoked landslides, and caused deaths in the region. An entire busload of the press corps, along with dozens of other buses and cars, was at that moment trapped ten miles away near the swollen Espíritu Santo

River, between a tunnel that had been sealed by a sliding boulder and the nearest bridge, which had collapsed. What sort of human being would show up in this catastrophe to listen to a campaign speech and shout a few slogans?

The answer was a crowd of several thousand descendants of Bolivia's earliest inhabitants: *pueblos indígenas* or *originarios*—first, or original, peoples, as they variously prefer to be called throughout the Americas. Many had forded swollen streams and walked miles to stand here on the outskirts of Villa Tunari, impervious to the hammering rain and the ankle-deep, sticky mud that sucked shoes and sandals off their feet.

A lucky few of us in the press had made it across the river by skidding in a 4x4 along the ruins of the bridge. By the time we arrived, people had been standing in the downpour for hours, wedged shoulder to shoulder and back to belly around a rickety podium, shivering under plastic capes or soaked to the bone, but until the rally ended at sunset, the crowd never thinned. The men and women in this audience had gathered here on a historic mission, after all: Following centuries of humiliation and in defiance of the law of probabilities, they were about to produce the next president of Bolivia from their midst.

The candidate was Evo Morales, who was elected in December 2005 and, in one of the most unstable of all Latin American countries, remains in power two and a half years later. His rule has been fraught with difficulties: Bolivia, geographically divided between the prosperous tropical lowlands and the impoverished Altiplano, is now more politically divided

between these regions than ever before. An autonomist movement in the eastern, whiter half of the country threatens the stability of his government. But it is worth remembering how improbable Morales's rise seemed even on the day of the rally in Villa Tunari, only weeks before the election. In the administrative capital, La Paz, the light-skinned, business-suited men of influence I had talked to a few days before the rally were contemplating this possibility with a mixture of contempt and disbelief. An Indian president? He could never be elected. Or: He will be elected, but he will never last.

On the podium, men wearing garlands made of flowers and the leaves of the coca plant gave speeches in languages I could not understand: the Quechua and Aymara of the Inca Empire, still more familiar than Spanish to virtually everyone in the audience. The candidate, whose broad, hatchet-nosed face peered out above the garlands of coca, fruit, and harvest vegetables around his neck, stepped forward and began his speech in heavily accented Spanish. "We are Aymara, Quechua, Guaraní—the legitimate proprietors of this noble Bolivian land!" he cried, to long cheers and applause. Noisemakers crackled. Somewhere, someone beat a deep-toned *bombo* drum. A president whose Spanish is not native? Impossible.

The men and women next to me turned aside whenever I attempted conversation. They smelled of soaked wool and smoke. Most of the women wore flat-brimmed straw hats over their long black braids, Quechua style, and they flaunted brightly colored, above-the-knee velvet skirts



Greeted like a rock star, President Evo Morales (center) arrives in the rural province of Chapare, where he once led the coca-growers' union, to inaugurate new schools—a top priority of his administration.

worn over many short petticoats. The Aymara women, who in general have more imposing figures and broader faces, were dressed in longer skirts and embroidered shawls, topped by bowler hats. The men, dressed in faded and mended polyester shirts and slacks, each had a big bump protruding from one side of his face—the wad of coca leaves that native people throughout the Andean region keep constantly tucked in their mouths.

The crowd answered an exhortation by the candidate by chanting, waving their fists in the air, stomping, rattling their flags. “This effort of yours has not been in vain,” Morales declaimed,

and they applauded the next president of Bolivia, and themselves. They had been fighting together ever since he was ■ poor farmer like them, a producer of the age-old crop of coca and the leader of a long, rough battle against the forces of the United States’ war on drugs, centered in this very region. They had fought stubbornly and mostly without weapons in endless confrontations with army troops and antidrug police—largely by refusing to budge, just as they were now showing their support in the downpour.

THE ASCENT TO POWER of a new elite of militant indigenous people has been a long time coming.



In the valley that cups La Paz, Bolivia's administrative capital, workers live near the rim at about 13,000 feet, where the air is thin. Big businesses and wealthier residents settle more comfortably down below.

Nearly 500 years ago the Spanish conquistadores arrived and transformed Bolivian territory into what was essentially a forced labor camp. The Quechua and Aymara highland communities were broken up, and the people were forced to toil in suffocating mines or pressed into working on haciendas, left free just long enough to scratch out a subsistence from the land. The original inhabitants of the Bolivian Amazon have fared no better: After independence came in 1825, they were herded into deadly camps in the lowlands to harvest the latex of the hevea tree for export as rubber. As recently as the 1980s they were driven off their fertile lands by

migrant Indian communities from the highlands, like those that settled in Chapare. Andean history is scarred with Indian rebellions, but tragedy was the outcome of most, and they brought little change. Across Bolivia and well into the 20th century, indentured labor remained legal. To this day in outlying regions, women are raped by their *patrón* almost as a matter of horrifying routine—and children from such unions bear a lifelong stigma.

In 1952 a nationalist revolution led to sweeping land reform and gave the vote to women and Indians (previously excluded as “illiterates”). But for most of the century a corrupt military elite



Before dawn a police squad prepares to head out on a search for cocaine labs. Small farms near the rural town of Chimore have been battlegrounds in a controversial antidrug war backed by the U.S.

controlled the country. When the generals finally retired from power and called for elections in 1982, Bolivia was the poorest country in South America and one of the most indebted. Its experience of modern civic life was nonexistent, and the chasm between the overwhelmingly Indian majority and the tiny, lighter skinned elite could not be bridged. Five consecutive presidents were not so much elected as picked from the white ruling class.

Which is not to say that apathy ruled the land. The country was in a state of almost nonstop turmoil, thanks to radicalized priests, local unions and organizations, and thousands of

unemployed and highly politicized displaced miners from the highlands who had migrated to the Chapare region to set themselves up as coca farmers. The coca farmers, who were growing a crop that in Bolivia is as traditional as tobacco and were often diverting it to the illegal cocaine market, battled Bolivian troops trained by U.S. special forces. The priests and union leaders organized entire communities to march for their rights. A short-lived nativist guerrilla movement bombed a few electrical pylons and put out the idea of a return to the Inca Empire. From 2000 onward, each day seemed to bring a fresh barrage of marches, roadblocks, strikes.

## TWO BOLIVIAS

Profound economic, ethnic, and geographic differences divide a land rich in traditions and resources.

Indigenous communities predominate in the mountainous west. Descendants of Europeans control businesses in the eastern lowlands.

**Identity** Sixty-two percent of Bolivia's ten million people trace their descent from a pre-Hispanic culture.

**Coca** Chewing leaves of the sacred coca plant has long been part of indigenous life, but some of the modern crop is made illegally into cocaine.

**Mineral Wealth** Bolivia has South America's second largest proven natural gas reserves, along with deposits of tin, zinc, silver, salt, and oil.



And in December 2005, as if in a sudden rush of understanding of the power of their numbers, Bolivian Indians went to the polls with a common goal. In the 2001 census, 62 percent of the population had identified itself as indigenous. Six weeks after the rally in Villa Tunari, Evo Morales won the presidential election by 54 percent (the first such majority win in decades), with the lowest abstention rate ever. Native communities all over the country elected dozens of their own members as representatives to both houses of congress. Upon taking office—in a ceremony that included traditional Andean rites officiated by Quechua and Aymara *amautas*, or priests—President Morales appointed four cabinet ministers with Indian last names or cultural traditions and called for elections to an assembly charged with drafting a new constitution. Dozens of Indian delegates

could be seen bustling in their brightly colored attire when the assembly was in session. In addition to Spanish, all of the 36 native tongues spoken in Bolivia were declared official languages in the draft constitution. Five centuries after the conquest, there was the possibility of a New World in Bolivia.

IN THE MEETING HALL of the unprepossessing municipal building of Achacachi, a town that lies more than 12,000 feet above sea level, councilwoman Gumersinda Quisbert, 42, sat on a broken-down plastic sofa, looking sturdily out at the world from under the gold brim of her bowler hat. Wrapped in a threadbare embroidered shawl, she spoke fiercely—although in halting Spanish—about the transformations in her home district, now led by an Indian mayor and an Indian council.



“Before, we campesinos had no way of getting into a government official’s office,” Quisbert said. She gave an example: “I was involved with my husband in a lawsuit, and whenever I went to court, since I wore a *pollera* [the traditional long petticoats and skirt] they always told me to wait outside.”

Quisbert had spent the morning in a council meeting called to explain a construction budget to the representatives of a village in the district. The meeting was in Aymara, salted with modern terms in Spanish for “zinc roofing” and “ecological

One had to wonder if wives came in for a crack of the whip more often than husbands, and, indeed, if Quisbert’s gender was held against her in her own ayllu. I asked if her new public visibility was creating any problems with her husband. “¡Sí!” she replied. “Women are always looked down on when they go out. Husbands are never pleased about it.”

At that moment someone interrupted us with a message from the council president to the effect that if I was interviewing the low-ranking Quisbert, then I should interview him first.

### **Andean history is scarred with Indian rebellions, but tragedy was the outcome of most, and they brought little change.**

standards.” The audience—as far as I could tell, just about all the adults from the village, including nursing mothers and their offspring—filled all the gilded imitation-Louis XIV chairs in the dingy room and listened with unwavering attention, asking what seemed to be pointed and direct questions of their elected representatives. The meeting felt as open and purposeful as, say, one in a New England town hall.

Some of the changes in Achacachi were perplexing, though. A long-standing demand of the pueblos originarios that Evo Morales turned into a campaign promise and wove into the draft constitution was that the ayllus, or traditional rural communities, be allowed to settle local disputes according to their own age-old system of codes and punishments. After winning the presidency, Morales appointed a Quechua union leader, Casimira Rodríguez, as his first justice minister to supervise the change. Many Bolivians worry about having parallel justice systems in what is already a divided country, but others say ayllu justice skirts the bureaucracy and privileges conflict resolution over punishment. Quisbert, however, offered a different example of how the new system worked: “If a husband and wife fight,” she explained, “if the case is handled in town, before a court, a fine will be applied. If the case is judged within the ayllu, a whip will be applied.”

Some changes, clearly, were taking place more slowly than others.

MOST OF TODAY’S Indian leadership emerged in the 1980s out of indigenous social movements, and so its members are doubly hated by the conservative white elite in the tropical southeastern flatlands, where most of Bolivia’s money is made—through the natural gas and oil industry, banking, agriculture, and cattle ranching. There are strong autonomist movements in these eastern provinces demanding more control of local resources, and the conflict with the new government has been escalating. For their part, the Indian and grassroots movements remain highly confrontational, and none of the structural problems keeping most of Bolivia’s citizens poor and angry have been solved. One of Evo Morales’s goals, even before he took power, was to reform the constitution to allow for repeated five-year terms in office. That measure has temporarily been defeated, and the question remains how long he can survive as the head of such a volatile nation—and as the former leader of a movement used to showing its displeasure with presidents by overthrowing them.

Morales first gained public attention as the leader of the combative Chapare coca farmers, a rough-and-ready organization reviled by the political elite. A man of some charm, he





Sons of the Altiplano, officials celebrate the founding anniversary of Ayparavi—one of just three communities where the 2,500 remaining Chipaya people live. Overhead, portraits of the great heroes of Bolivia's 19th-century fight for independence from Spain flank the national coat of arms.



Aymara women in traditionally styled uniforms clear weeds from a green at La Paz Golf Club. They earn about \$100 ■ month. Members, from among the city's elite, pay an initial fee of \$12,000, plus monthly dues, for the privilege of playing on one of the world's highest courses, at 11,000 feet.



was at first visibly uncomfortable dealing with people who knew more than he did about a given subject, like economics or protocol. At press conferences he relied heavily on Alvaro García Linera, his urbane vice president, a former member of the guerrilla group that proposed a return to the Inca Empire (but himself a fair-skinned member of the elite), to prompt him on the facts.

Lately, however, President Morales has grown into his role. And given his own radical leanings and the turmoil he inherited, he has managed to steer a remarkably even course. As of this spring, his approval ratings have remained good, despite his continuing failure to achieve a consensus among opposing interests as to the future of the fractured nation. The marches, roadblocks, and confrontations with the army and police that toppled his predecessors have still not reached the anarchic levels that had the country in ferment before his election. He has zealously pursued the eradication of institutional corruption—although there can be little hope of achieving that soon. He retains a visceral dislike of Washington from the days when he led the fight against the U.S. antinarcotics program, but he has kept relations with the Bush Administration within the bounds of protocol. And his two most controversial measures—the nationalization of the hydrocarbon industry and an ambitious land reform program now being carried out—have lost no international investors.

Iván Arias, an expert in municipal planning who has long worked with Indian communities and is a close observer of the government, says Morales has already lasted longer in power than most non-Indians expected because he has popular support—and the cash flow to retain it. “A great deal of money is pouring in,” Arias told me. “There is the new oil and gas money, money from tourism, and from what Bolivians working abroad send home. And then there is money from the cocaine trade.” The area under coca cultivation grew by 8 percent in 2006, though the number of cocaine labs destroyed was up by more than 50 percent.

Arias told me that Morales, who was a highly visible congressman before he ran for the presidency, practices politics the way he plays soccer, one of his passions: “He is a great opportunist, so he knows how to convert goals.” There are, in fact, among his opponents in both the indigenous and white communities those who say that for a politician who plays soccer, wears blue jeans, and now barely speaks his parents’ native Aymara, to campaign for office as an Indian was in itself an act of skillful opportunism.

BUT WHAT ARE THE REQUIREMENTS for being Indian? And if one is Indian, is one Bolivian as well? If so, which identity has priority? In the new Bolivia these deeply philosophical questions are suddenly as common as the dispute over whether the winner in the most recent Miss Cholita (Miss Little Indian) contest could be authentic if her braids were false, and as serious as arguments between the military and indigenous groups over whether bright, checkered Indian flags called *wiphalas* can be carried in the annual military parade in Santa Cruz.

“In reality, for us Bolivia does not exist,” said Anselmo Martínez Tola, a slow-spoken and affable man from the Potosí area who was, according to a sign above the door, the “mallku on duty” at the painfully bare La Paz headquarters of the National Council of Ayllus and Markas of the Qullasuyu. The council’s name refers to the “national federation of Quechua and Aymara communities of the quadrant of the old Inca Empire that once encompassed the Bolivian Andes,” and despite its barren headquarters, it is one of the most powerful Indian organizations in Bolivia, with ten delegates to the constitutional assembly. “Bolivia is a name that was imposed only 183 years ago,” the mallku, or traditional leader, elaborated. “I feel more Quechua than Bolivian, more originario than Bolivian.” He acknowledged ruefully that he was not wearing traditional Indian garments, and I asked him whether his children would still be Indian if they were born outside the ayllu, spoke Spanish, wore jeans, and emigrated to New

Jersey to look for work. "Of course," he said. "The same blood still runs through their veins. That blood cannot be changed."

Abel Mamani, a slight, alert man who until recently was the minister of water, had a different view. Before Morales's election Mamani was head of the Federation of Neighborhood Councils for the immense, 30-year-old city of El Alto, which lies just outside La Paz—or really, just above it, since it sits on the rim of the valley that gives shelter to the capital. El Alto is a chaotic city of migrants, most of them Indians

other kinds of people as well supposed to be a leader for Indians only?" A national politician who declares himself or herself an Indian faces some troubling moral questions, he said. If he were rich, would he be less Indian? Could one seriously say that skin color determines character? And yet, he went on, he was undeniably not a *qara*—which means "white."

"When we say that I am Indian," he said at last, "I think we are talking about origins. Perhaps we are also talking somewhat about a way of seeing the world."

### **For the Ayoreo, the cultural shock and displacement suffered by the Andean peoples during the conquest is happening right now.**

from the countryside, and it is a center of political turbulence. It was here that the strikes and roadblocks that laid siege to La Paz were organized, starting in 2003, and it was Mamani who, as the head of the El Alto federation, led the strike movement in the acrid year of 2005. Water being one of the most volatile issues in Bolivian cities, and particularly in El Alto, Morales created a ministry for it. Mamani, 41, who had held a number of odd jobs, was its first head. (As poor when he took office as many members of the cabinet, and more talented than most as a politician, he was dismissed last year on grounds that he misspent public funds while on official trips to Europe.)

I asked Mamani if he was an Indian, and he smiled wryly. "I am an Indian leader who emerged from political movements protagonized by Indians and other poor people," he said. "But I do not come from the countryside. My grandparents did, and so did their ancestors. They could say that they were originarios. But my parents emigrated to a town, and I was born there. As for my children, they're completely citified." He shrugged, palms up. "There's another thing to consider: El Alto is one of the three largest cities in the country. There is a mix of people there from all over Bolivia, and from all the social classes. So, is a leader there who is surrounded by Indians and

AWAY FROM THE WHEEZE and roar and choking smog of a highway on the frayed edges of the wealthy tropical city of Santa Cruz, there is a dirt road paved with garbage. Just off that road lies Barrio Bolívar, a dozen or so mud-wattle shacks more or less identical to thousands of others ringing the city. The shacks are grouped around a dusty central clearing bordered at one end by a small evangelical chapel made of brick and at the other by the pride of the community—a two-room schoolhouse, also brick. Off to one side, a couple of loops of chicken wire enclose more dust and garbage and a few plants—a zinnia, a lanky avocado.

Next to this garden, and surrounded by dust, flapping plastic bags, and empty kerosene containers, three old, brown-skinned men sat one breezy afternoon, dressed in T-shirts and jeans, whittling strips of lumber into arrows. They were members of the Ayoreo ethnic group, who even in the 1960s were among the fiercest protectors of their homeland, the Chaco region—missionaries who ventured there risked meeting unsavory deaths. They decorated themselves with ritual paint and traversed the forest between Bolivia and Paraguay, hunting and fishing, gathering honey, and growing beans, corn, and squash during the rainy season. Four years ago a group of 17 Ayoreo, physically and emotionally exhausted, emerged



Workers at Huanuni, Bolivia's largest tin mine, are government employees with guaranteed salaries. At private operations, miners must sometimes rely on luck to make money—and stay safe.

from their shrinking forests in Paraguay and exchanged their seminomadic life for one like that of their kin in Barrio Bolívar, where the infant mortality rate is devastating and few job opportunities exist. For the Ayoreo, the cultural shock and displacement suffered by the Andean peoples during the conquest is happening right now.

These days they seem to be adapting more, if not necessarily better, to the capitalist way of life. The former hunters rove the streets of Santa Cruz selling their arrows, or in the case of some of the women, themselves, but they seem to have retained their pleasure in

conversation, and soon the three men and I, joined by other community members, were attempting one, with the help of a woman from the community who spoke Spanish. We talked about anteaters, which they hoped to hunt for in their ever receding forests, and about how delicious they are and the fact that they have very long tails. We exchanged pleasantries about Mexico, which they had heard about because of ranchera music, of which they were fond, until at last everyone's vocabulary ran out, and we made our farewells.

Groping for a definition of what it is that distinguishes Indians from other human beings,





Near the entrance to the public university in Cochabamba, graffiti sharing a wall with leftist icons target the Movimiento Al Socialismo, Evo Morales's political party: "Down with the reforms of MAS!"

Abel Mamani had said that they were bounded by a certain way of seeing the world, but it would not necessarily occur to an outside observer that the Ayoreo, whose introduction to the modern world is so very recent, have much in common with the hardworking, goal-driven Aymara and Quechua. The peoples of the highlands are in too many ways—in their dress and their forms of land distribution, for example—children not only of the Inca Empire but of the Spanish crown and the 1952 nationalist revolution. It was the Spanish conquistadores who saw “Indians” where there are still, in Bolivia alone, more than 50 distinct cultures

and language groups, and it is the great danger of the current government to see the powerful Aymara and Quechua majority as representative of all the first peoples in Bolivia.

What did he aspire to, I had asked the president of the municipal council of Achacachi. The Qullasuyu—the Inca Empire, he answered. But the Ayoreo woman who courteously translated for her people in Barrio Bolívar had a simpler and more urgent goal. “We want help getting scholarships for our youths, so that they can leave the barrio and get a good education somewhere,” she said. Between that hope and that need there is room for a better Bolivia. □



The skull of *Junggarosuchus sloani*, a primitive land-dwelling crocodylian, is part of a trove of fossils shedding light on a poorly understood moment in dinosaur evolution.



# The Real Jurassic Park

A fossil bonanza in northwestern China  
shows that the ancestors of *T. rex*  
and other reptile giants started small.

By Peter Gwin NATIONAL GEOGRAPHIC STAFF

Photographs by Ira Block

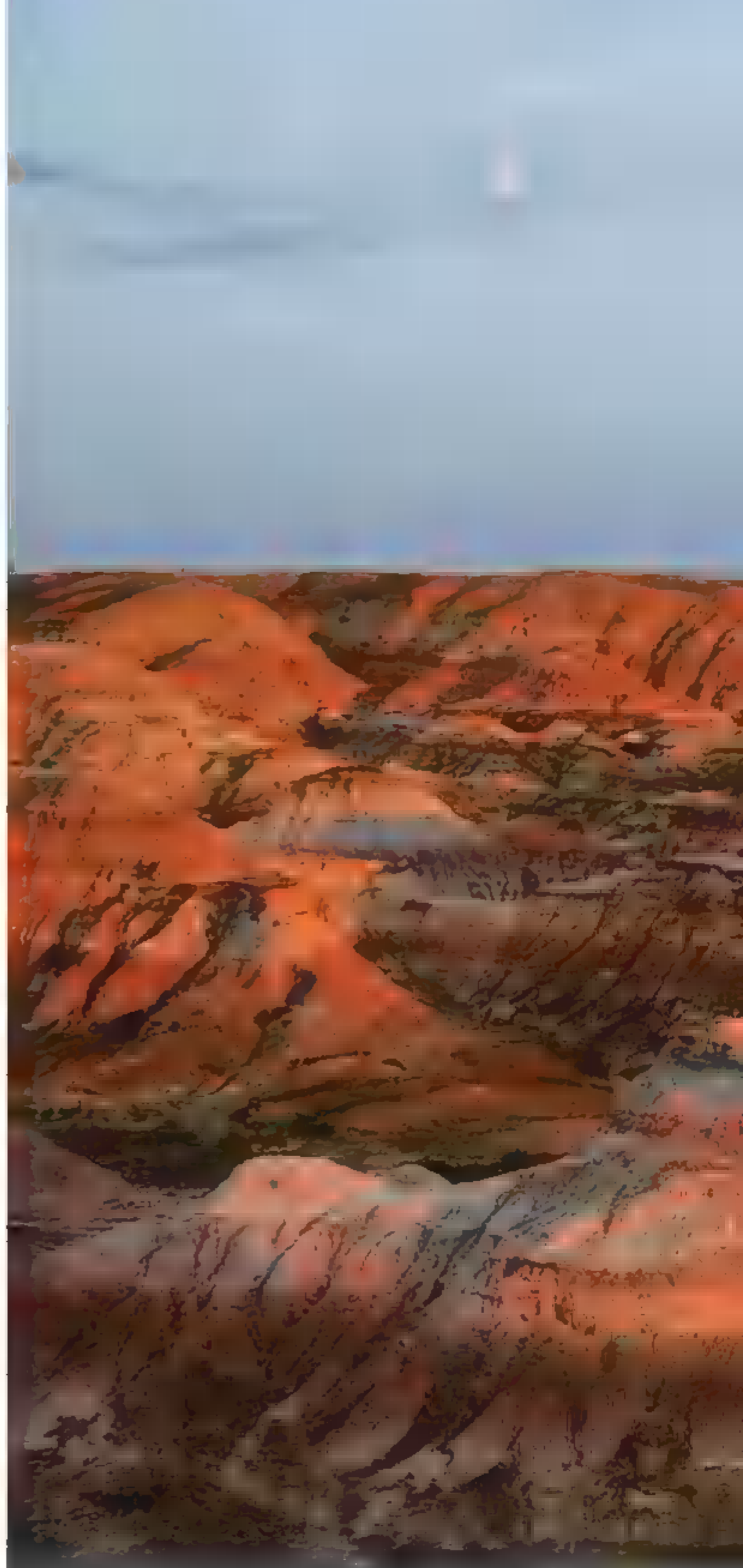
## Perhaps the shriek of a dying animal

enticed the dinosaur into the trap. Or maybe it was the scent of rotting flesh. Whatever the bait, once the predator was lured into the mud pit, it quickly forgot its prey. It thrashed futilely in the mire for a long while, but its legs couldn't reach the bottom. Doomed, the animal slowly accepted its fate and succumbed to exposure, but not before its struggle attracted another predator to the pit, continuing the cycle of the death trap. Eventually the mud turned to stone, entombing its victims, stacked one on top of another, for 160 million years.

This is the story contained in a column of rock unearthed in northwestern China's Junggar Basin. But that column is just part of a startling collection of fossils excavated over the past seven years by paleontologists James Clark and Xu Xing with support from the National Geographic Society. Their discoveries are opening a new window onto an obscure period in Earth's geologic history—a violent interval that lasted from about 165 to 155 million years ago and saw the continents breaking apart and dinosaurs undergoing a burst of evolution. As

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*Ira Block has been shooting for National Geographic since 1977. His many assignments have taken him from Australia's outback to the North Pole.*



landmasses divided and animals became isolated from each other, a profusion of new branches sprouted on the dinosaur family tree. These new branches eventually yielded many famous dinosaur groups, including horned ceratopsians, armored stegosaurs, and tyrannosaurs. But the dearth of terrestrial fossils from this ten-million-year span had vexed scientists. "We could trace these groups back through time to this period, but then the trail went cold," says Clark, a professor at George Washington University.

In 2000 Clark joined Xu (pronounced shoe), ■ rising star at Beijing's Institute of Vertebrate Paleontology and Paleoanthropology, for a



China's Junggar Basin, once a marshy realm filled with dinosaurs, is now an arid badland haunted by hawks and wolves. Scientists prize its rock outcrops, some of the few on Earth that date to around 160 million years ago, when dinosaur species were greatly diversifying.

scouting trip to the Junggar Basin. The following year the two scientists mounted a full expedition to the basin's Shishugou formation, one of the few places on Earth where the exposed rock dates to the Middle Jurassic. Some 160 million years ago it was a marshy realm at the foot of a small mountain range riddled with volcanoes. Now it is a series of desiccated badlands and dunes splayed along the Gobi desert's western edge.

"We intentionally chose an area where I had

seen a lot of small fossils," says Clark, noting that small prehistoric species tend to be rare, more difficult to find than large creatures. The excavation of one massive skeleton, like that of a multi-ton sauropod, can take an entire field season, Clark says. Instead, he and Xu focused

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■ **Society Grant** Funding for this research was made possible in part by your Society membership and by ■ grant from the National Science Foundation.



Outline body parts  
missing at excavation

# The Trap

During a single wet season sometime between 165 and 155 million years ago, five small dinosaurs were ensnared in a mud pit, possibly formed when a massive sauropod stepped into wet volcanic ash. The animals—all bipeds with relatively weak forelimbs—probably thrashed in the mire, attracting more predators and scavengers to the site.



**A** **Guanlong**  
 An adult Guanlong, the largest known tyrannosaurid, may have become stuck while preying on trapped juvenile Guanlong.

Limbs of Guanlong, possibly covered in mud, may have made for greater recognition as the dinosaur thrashed.



**C** **Unknown**  
 An unidentified dinosaur found beneath the two Guanlong skeletons may have lost its head and limbs to a predator.

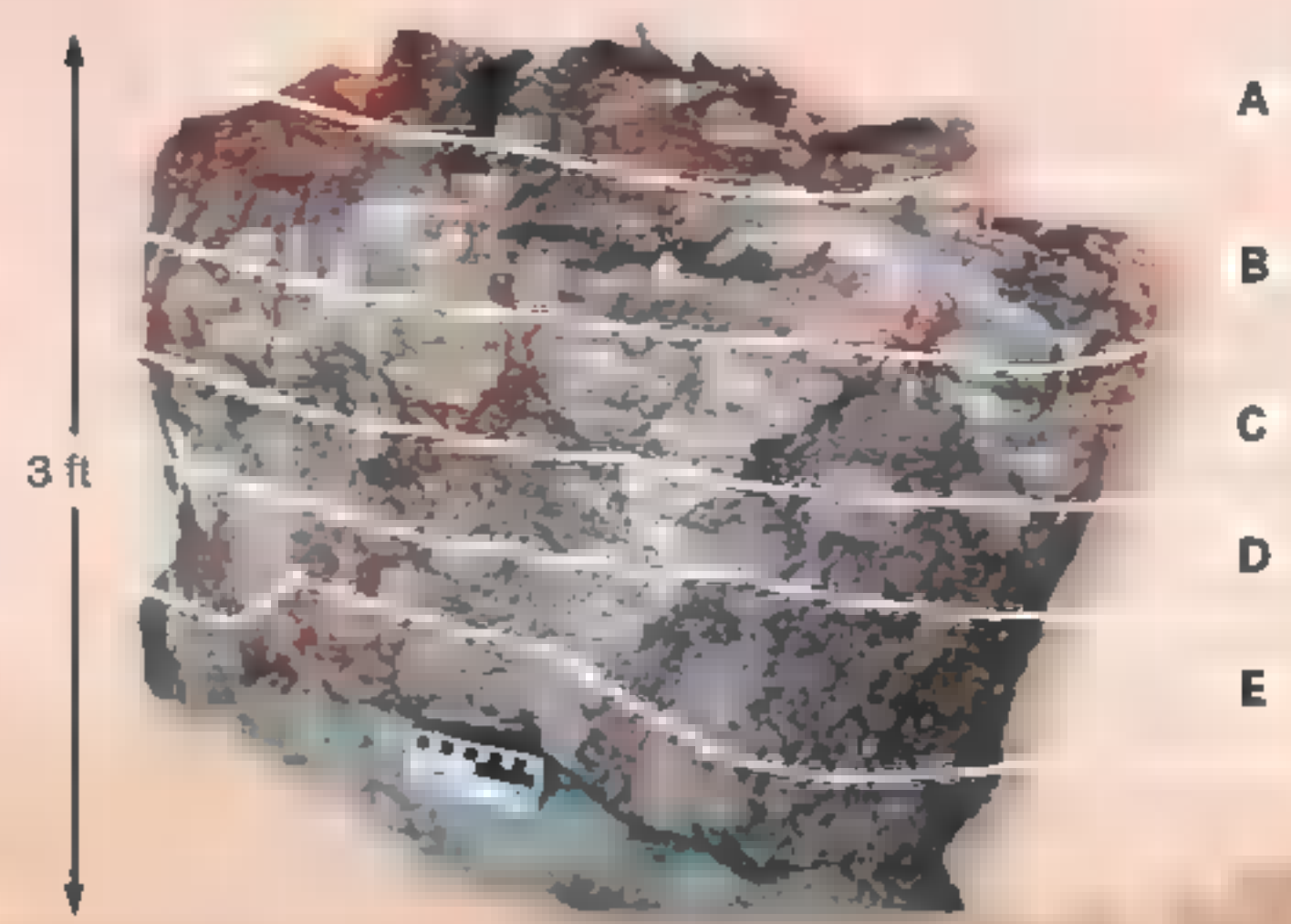


**D** **Ceratosaur**  
 Two of these primitive carnivorous dinosaurs were found at the bottom of the pit; both were also missing their skulls.



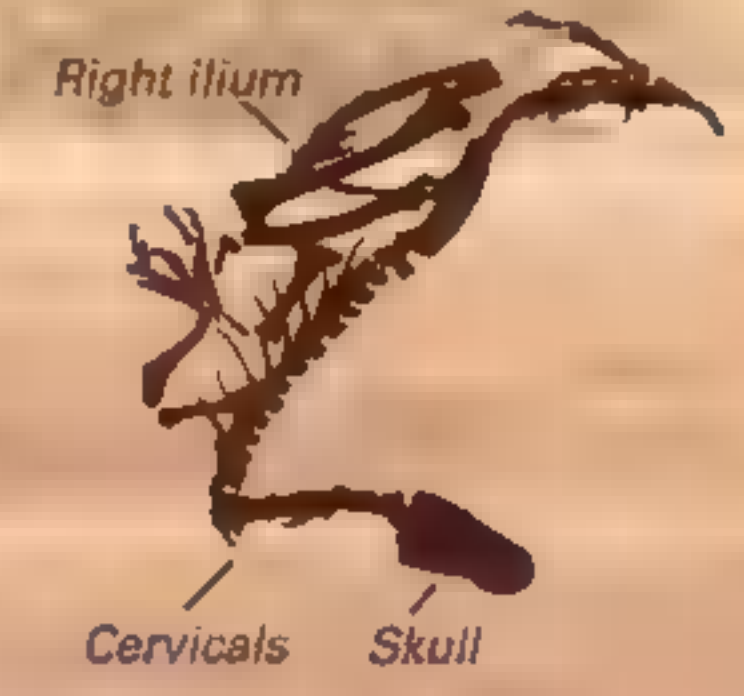
# The Tomb

The fossils are stacked on top of each other in a column of rock. The highly mixed sediments indicate that the animals churned up the mire during their death struggles before giving in to exhaustion.

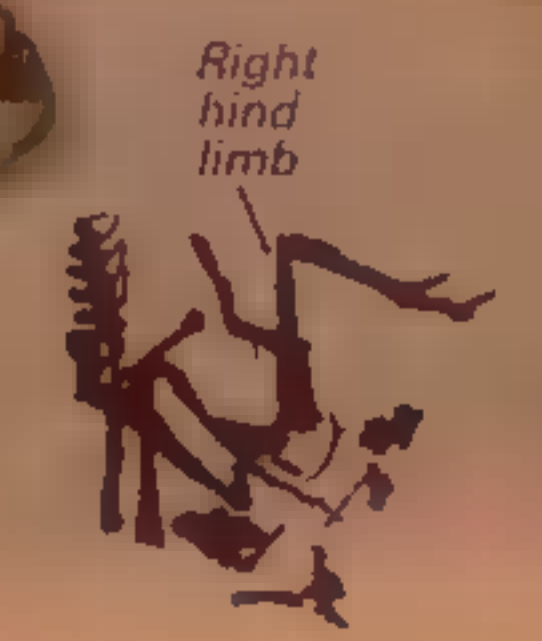


A  
B  
C  
D  
E

Guanlong's D-shaped, serrated teeth foreshadow those found in later tyrannosaurs and taken to extremes in *Tyrannosaurus rex*.



The subadult's snapped neck suggests a violent death. Guanlong probably preyed on its own kind.



JUAN VELASCO, NG STAFF ART BY RAUL MARTIN  
 SOURCES: JAMES CLARK, GEORGE WASHINGTON UNIVERSITY  
 DAVID A. EBERTH, ROYAL TYRRELL MUSEUM ALBERTA  
 ALL FOSSILS COURTESY INSTITUTE OF VERTEBRATE PALEONTOLOGY AND PALEOANTHROPOLOGY, BEIJING  
 DAVID A. EBERTH (TOP)

# Dinosaur Death Block



Once paleontologists James Clark and Xu Xing found the remains of multiple dinosaurs buried together, they had to figure out how to extract the two-ton rock tomb in one piece (above) and transport it 1,500 miles from their remote site at Wucaiwan back to a Beijing lab. Their team began by carefully digging around the fossils and isolating them in a single block, which they slathered in plaster. A crate was cobbled around the block, and it was slowly winched out of the ground, using iron bars as rollers to slide it into a truck. At the lab, it took four years of delicate cleaning for the dramatic story contained in the block to unfold.



JAMES CLARK (ABOVE); NGM MAPS



Lab technicians are still preparing many of the 600 fossils found at Wucaiwan over the past seven years, now preserved in plaster cocoons. So far 40 species have been identified, most of them new to science.





# When the Giants Were Small

Several of the new species found in the Junggar Basin are the diminutive ancestors of giants that reigned near the end of the dinosaur age. What caused these early species to evolve over tens of millions of years into descendants 70 or more times heavier? One clue can be found in their changing environment: Flowering plants were emerging, creating a plentiful, nutrient-rich new food source. But the trend to gigantism may also have been part of an evolutionary arms race that saw plant-eaters enlarge as a defense mechanism against predators, provoking carnivores to grow bigger in order to hunt them.



*Guanlong wucaii* is the earliest known member of the tyrannosaur line, which culminated with the fearsome *T. rex*.



Early beaked dinosaurs like "*Gongbusaurus*" *wucaiwansensis* evolved into the great duckbills of the Cretaceous.



*Yinlong downsii* is the earliest known ceratopsian dinosaur. The group later produced horned giants such as *Triceratops*.



on quantity, a strategy they hoped would yield plentiful clues about the missing segments of the dinosaur panorama.

As their team of Chinese and North American scientists and excavators began to dig, a menagerie of primitive creatures emerged from the rock, including new species of turtles, crocodilians, winged pterosaurs, and early mammals. Many exhibit the onset of traits that evolution would magnify in later species. A ceratopsian skull, for example, bears a bony halo, hinting at the massive horned frill that would crown its descendant *Triceratops* tens of millions of years later. A partial stegosaurian skeleton offers a look at one of the earliest known members of the famous armor-plated dinosaurs.

High on Clark and Xu's wish list was to find a theropod, a type of two-legged, meat-eating dinosaur from the lineage that led to birds. So it was with giddy expectation that the team began to excavate a skeleton of an unknown bipedal hunter. As Clark and Xu dug down around the theropod, they kept encountering more bones. "We realized that another theropod was buried under the first," says Clark. "And we suspected more were below that one. That's when we got even more excited." All told, they removed a column of rock containing five small dinosaurs.

Later, in Beijing, Xu and his technicians began extricating the fossils from the rock using micro-drills and dental picks. An analysis of the rock revealed large amounts of volcanic ash, suggesting an eruption had occurred not long before the animals died. David Eberth of the Royal Tyrrell Museum in Canada, the team's geologist, believes that thick veils of ash fell into the marsh, creating a viscous mud. As massive sauropods lumbered across this soft ground, their footsteps could have made the pits that became dinosaur death traps.

So far, the team has located three of these death pits, each a diorama of a desperate struggle. One features a crocodilian huddled next to a small ceratosaur; another contains three headless ceratosaurs, possibly decapitated by predators big enough to avoid getting stuck in the trap. The most spectacular of the pits

(see pages 108-110) contains the remains of a 170-pound tyrannosauroid. Xu named it *Guanlong*, Chinese for "crowned dragon," a reference to a crest that stretched from its snout to the back of its head. Its discovery sent rumblings through the paleontology community, because it represents the earliest and most primitive of the infamous "tyrant lizards," a family of powerful predators that culminated more than 90 million years later with the most fearsome of them all, *Tyrannosaurus rex*.

"What's striking about this find," says Thomas Holtz, a tyrannosaur expert at the University of Maryland, "is the revelation that *T. rex*, the king

These discoveries are opening a window onto an obscure period in geologic history—a violent interval that saw the continents breaking apart and dinosaurs undergoing a burst of evolution.

of the tyrant lizards, comes from such humble origins. Most people think of tyrannosaurs as dominant predators, but that was toward the end of their line. For most of their history, they probably were the jackals of their day."

To its surprise, the team found a second, smaller *Guanlong* beneath the first, leading to speculation that an adult had gone after a youngster trapped in the pit. It's possible, says Holtz. "We have numerous tyrannosaur skulls that bear bite marks from other tyrannosaurs."

Clark and Xu are eager to explore new parts of the Junggar Basin later this summer. "There's still so much to find," says Clark. "I can't wait to see what turns up next." □

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✦ **Digging Deeper** Why is China's Junggar Basin such a fruitful place for fossil hunters? Find out by visiting the GeoPedia section of [ngm.com](http://ngm.com).



# UNDER FIRE

**FROM THE ROCKY MOUNTAINS TO THE COAST OF CALIFORNIA,  
WILDFIRES ARE BURNING BIGGER, HOTTER, AND CLOSER TO HOME.  
WHY IS THE WEST ABLAZE?**







**TORCH IN HAND**, firefighter Iles Nelson calls a backfire during a night operation in Montana. Deliberately lighting fires to burn toward an advancing wildfire and consume fuel is a common tactic where water is scarce. Crews working in the West must often hike for miles with heavy packs to reach the flames.

**IN A LAST-DITCH EFFORT,** firefighters covered the Scott Mountain lookout in heat reflecting wrap to protect it from fire charring through Boise National Forest. It survived. Such lookouts, many built in the 1930s, play an important role in spotting wildfires.









**WITH A DEAFENING CRESCENDO,** flames hurtle through a thick stand of firs. Nearly a century of aggressive fire suppression has left many western forests overgrown and extremely vulnerable to wildfire. Years of drought have only worsened the problem.

**THE YOUNG MEN WADE THROUGH THIGH-HIGH GRASS** beneath the firs and ponderosa pines, calmly setting the forest on fire. They carry torches, dispensing burning droplets of gasoline and diesel fuel. With flicks of the wrist they paint the landscape in flame. The newborn fires slither through the grass and chew into the sagging branches. Every few minutes a fir ignites, flames devouring it in a rush of light, the roar of rockets. It is over in seconds. Only a smoking skeleton remains.

The men, firefighters, enjoy this immensely.

“Did you kill a tree, man?”

A big grin. “Yeah.”

“I love that sound.”

It is 11 a.m. on a Saturday in July, and Idaho is ablaze. More large wildfires burn here now than anywhere else in the nation. Columns of smoke wash over the state, evacuation warnings following. This fire, called Lucky, burns in the Boise National Forest, a couple hours’ drive north of the capital. Like many fires in the West, Lucky was started by lightning. After two weeks it has scorched some 1,400 acres. It is not the biggest fire in Idaho. But Lucky has *potential*, firefighters say, as if they were speaking of a gifted child.

For hours they light fires with torches and hand-thrown flares the size of beer cans. In theory, backburning starves an advancing wildfire by eating the fuel in its path. But fire is sly. There is almost always some way for it to spread. And backburning is risky. Tales abound of burns that swelled out of control, and the men who took the blame.

Later in the afternoon the firefighters stand around admiring their work. Blackened acres stretch before them. Suddenly, on the hillside above, a shear of noise and a shudder in the earth. A huge tree has collapsed, its roots burned through. The firefighters are unfazed. They laugh and tease and lean on their axes. Then the wind shifts. A whisper from the north. The laughing stops, the men look up. Glowing embers, little incendiary bombs, glide overhead into unburned forest.

“Damn.”

They hustle into the brush, searching for new fires, hoping their names won’t go down on the list of those who gambled and lost. After a while they filter back out, finding nothing, satisfied that for now they have gotten away with it.

This is how we deal with fire in America, in small wagers. Fighting fire with fire, trying to prevent the landscape from doing what even firefighters say it wants to do: burn.

**W**ildfire advances by transforming vegetation into fuel. As plant matter heats, it releases compounds of carbon, hydrogen, and other flammable elements, which react with oxygen to release more energy, starting a chain reaction. Air around the fire warms and rises, sometimes creating winds that fan the flames. Extremely hot fires can manufacture their own weather systems, feeding and driving themselves, covering ground far faster than a sprinting human. Sudden wind shifts have pushed fire onto firefighters who believed they were safe.

The Western wildfire season generally begins in late spring and lasts into fall. Like other seasonal disturbances—hurricanes, tornadoes, ice storms—we have learned to fear its approach. Red walls of flame, leaden pillars of smoke. But fire is the one natural event we regularly treat as though it were alive and battle vigorously as if it were an invading host. There are no hurricane-fighters, no tornado-fighters.

More and more, we lose. While fire in densely populated California draws the most attention, forests and rangelands throughout the American West are burning at unprecedented rates.

BY **NEIL SHEA**

PHOTOGRAPHS BY **MARK THIESSEN**

BOTH NATIONAL GEOGRAPHIC STAFF

In 2006, wildfires burned 15,000 square miles across the country, a record nearly matched last year. Two-thirds of the burned acreage was in the West. One obvious cause is a decade of drought and warmer temperatures. Mountain snow melts earlier, and winter storms arrive later, extending the fire season in some regions by several weeks. Vast tracts of drought-weakened forest have succumbed to insects and disease, turning trees to tinder. In response, we have bolstered our fighter ranks, padded them with private contractors, provided them more hoses and axes and trucks. Annual federal spending on fire-fighting has leaped from \$1 billion when the recent drought began in 1998 to more than \$3 billion last year, with even greater costs

forecast for the future. But the drought is only one part of the burn equation.

“The more money we spend, the worse it gets,” one fire scientist told me last summer. “If that’s not a condemnation of our fire policies, I don’t know what is.”

Historically, the American approach to wildfire has been to try to suppress it whenever and wherever it appears. This strategy is often traced to the great fires of 1910. That year, massive blazes across the West burned millions of acres and killed dozens of firefighters. Smoke drifted as far as New England, along with tales of tragedy and devastation. Gifford Pinchot, first director of the nascent U.S. Forest Service, was convinced that fire threatened the economic well-being of



**“GOOD” FIRES** are ecologically crucial, clearing out dead brush and returning nutrients to the soil. Most of these ponderosa pines will survive, even thrive, after a low-intensity burn in South Dakota’s Custer State Park. “Trees respond to fire,” says Frank Carroll of the Forest Service, “like roses respond to pruning and fertilizer.”

the nation, and as the man in charge of a huge, federally owned empire of forested land, he was in a position to turn his ideas into policy. He began a campaign to banish fire.

“We understand that forest fires are wholly within the control of man,” he declared.

Under Pinchot and his successors, firefighting became a courageous struggle. We grew adept at killing fires, especially small ones. But we did not understand that fire, like rain, is necessary. Those firefighting campaigns, combined with a decline in logging and a growing conservation movement, meant vegetation—potential fuel—began to pile up. A study published in 2005 reflects the sort of change seen across the West. Researchers at Northern Arizona University studying two patches of Arizona forest estimated that in the late 1800s they contained about 50 trees for every 2.5 acres. After nearly a century without fire, up to 1,700 trees now crowd the same area.

By stamping out small fires and allowing fuel to stockpile, our policies ensured that when conditions were right, fire would return—bigger, hotter, more destructive than ever. And the right conditions could become routine. Most climate models now strongly suggest that the recent drought is not just a temporary phenomenon but part of a long-term drying trend made worse by global warming. There comes a point where no amount of money, no measure of heroism, is enough. Far from “wholly within the control of man,” fire becomes unstoppable.

Idaho’s Lucky fire represents the American firefighting world in miniature. Crews from all over the West and beyond have come to fight it and a few other fires nearby. They work dawn to dusk, sleeping in tents or on bare ground. Helicopters costing up to \$80,000 a day rattle overhead, dropping water and blood-red fire retardant. In a command tent far from the fire, the bill is tallied. By July 26, nine days

after the fire began, it was \$1.5 million. July 29: \$2.6 million. August 1: \$4.5 million. Dozens of fires burn elsewhere in Idaho alone.

Robert Barrett, the U.S. Forest Service firefighter in charge of battling Lucky on the ground, commands his men and women in a voice raspy from years spent sucking smoke. He is 46, slight and strong, with an easy grin and a scrub-brush

## THERE COMES A POINT WHERE NO AMOUNT OF MONEY, NO MEASURE OF HEROISM, IS ENOUGH. FIRE BECOMES UNSTOPPABLE.

goatee. He tours the fire on foot and in his pickup, divining its mood.

“Fire is cool,” Barrett says. “It’s cool trying to figure it out, seeing what you can do about it. It’s a mental exercise. You never know what it’s gonna do.”

Stones ping off the truck as Barrett steers down a road that is little more than a welt of dirt between ravines. His guitar, stashed beneath the seat, twangs in its case. He coughs often in long, wet runs. The heat and storms of smoke and dust have not dulled the thrill of a good burn. “I love my job. It keeps me out of jail.” A fireman’s joke.

Lucky has burned now for about a week. Each day Barrett wakes before dawn and makes coffee on the tailgate of his truck, thinking about his next move, and the fire’s countermove. At night, most fires here “lay down,” burning slower under wetter, cooler air and the suffocating lid of their own smoke. Because of this, firefighters occasionally attack fires at night, but it is dangerous work. More commonly, they exploit fire’s drowsiness in the early morning. By late morning the air generally warms and dries, and wind begins feeding the flames. At Lucky, the relative humidity can drop from 30 percent to 15 percent in a few hours. The day slides into the burning hours, when fire thrives.

More than anything, Barrett wants to keep Lucky from leaping a small river into a chunk of forest where trees stand dense and dry. He knows

that Lucky, like any wildfire, has the potential to rage out of control in the span of an afternoon. He also faces another problem, one that greatly complicates wildland firefighting today. If the fire jumps the river, houses and ranches lie in its path. Since the end of World War II, people have streamed into the West, injecting houses and roads and towns into places they never existed before. In the 1990s, eight million new homes sprouted along the borders of parks and forests, where fires regularly start. The government spends exorbitantly attempting to defend property in these areas. Formally this is known as the wildland-urban interface. Some firefighters call it the stupid zone.

Just before noon on a Monday, Barrett sends another crew in to backburn. It begins well. The scent of gasoline, flares popping. The tea-kettle whistle of combusting wood. But just after 1 p.m., the wind shifts. The fire bends back on itself, toward vast sweeps of trees, ready fuel. The wind shift could undo a week of work, or worse. Excited voices call over the radio. Barrett tugs on his backpack to hike the fire's edge and sense it for himself. He grabs a Pulaski, the combination ax and adze that firefighters use to chop, cut, and scrape.

Lucky advances down a steep ridge, the firs torching, hot orange declarations. We hike along a shallow firebreak of bare soil. Fire hoses snake through the dirt. To our left, thick green stands. To the right, a smoking expanse, like something shelled by artillery. Flames a few feet high snarl and hiss in the wind. Smoke swallows us, burning our eyes and plugging our throats. When it clears, I see Barrett hacking at a fire that has jumped the line, smothering it with dirt. Then he stops and stares at the forest below. Four, five, a dozen new pools of flame blink in the smoke.

"I think we've lost it," he says. The wet cough. He takes a radio call and his face falls. *That damn wind.*

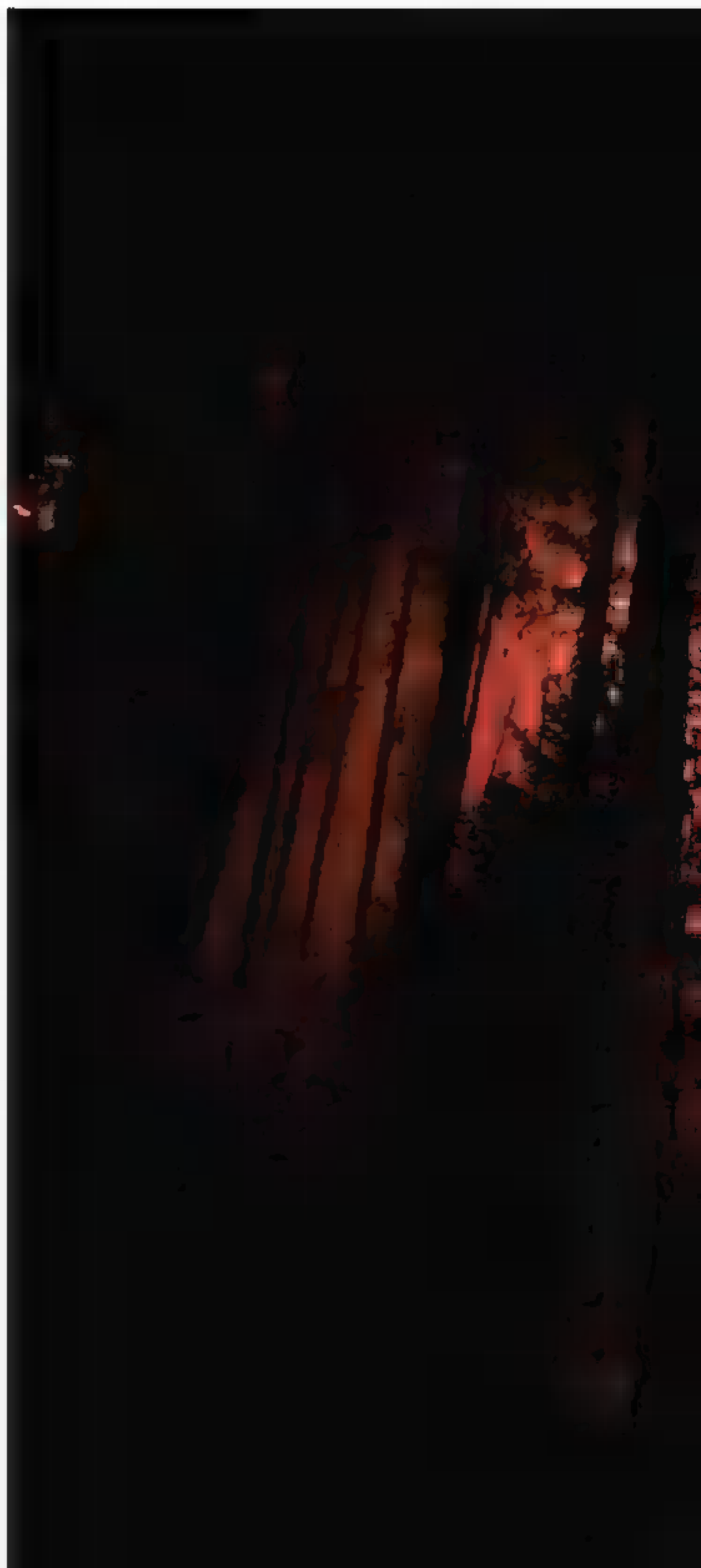
"I think it's gone across the river."

We retreat, following the hoses out. In places they are burned through, nicked arteries spurt-ing water. We drift in and out of heavy smoke. I

lose Barrett, glimpse him, lose him again. When we finally emerge, word comes that a crew has found and killed the fire across the river.

A few hours later Barrett sits cross-legged on a large boulder, a radio in each hand, hands resting on his knees. Still as a monk. No new fires have sprouted on the other side, and his firefighters have retaken the fire line. The turns of fortune. It might easily have gone the other way.

A helicopter passes, its orange bucket sailing overhead like a comet, mist trailing behind. Justin Bone, one of Barrett's lieutenants, watches it go and shakes his head. "We're spending millions on 1,500 acres," he says. "How many city fire departments would that pay for? They might as well be pouring dollars on the fire."




Like Barrett, Bone loves his job. And he shares with many others the belief that trying to fight all fires is a loser's game. Bone favors an alternative strategy called "wildland fire use," in which some wildfires are monitored but allowed to burn, gradually thinning the forests and clearing out fuel. It is not a new approach. Native Americans burned forests and grasslands to create game habitat and clear fields. Many plant species benefit from ■ periodic purging. Bone stabs a finger toward the forest, heavy with ponderosa pine. With their thick, tough bark, the trees can survive all but the most severe burns. Other pines require fire for reproduction; their seed cones are coated in a waxy resin that must be melted off by heat to free the seeds. As fire burns dead

wood and live plants, it also releases nutrients into the soil. This is crucial in arid zones, where decomposition without fire would take decades. Not all fires can be left to run their course, but the ecological argument behind the idea is compelling.

"That's the future, man," Bone says. "We need to learn to let things burn."

**L**ucky is one star in a constellation of fire. As it burns, other fires follow lightning storms through Idaho into Montana. Some flicker and die. Others are born where the wind is right and the ground good and dry. On satellite maps the West appears cancerous, red patches spreading.



**USING TERRAIN** as a tool, a firefighter shoots flares onto a hillside, hoping to create a chimneylike effect: As heat from this fire rises, it should draw flames upslope, away from unburned forest below. But fire doesn't always cooperate.

# COMBATING A BLAZE

Fighting wildfire is often likened to a military campaign, with personnel deployed strategically on the ground and air support striking from above. Planning an attack, as here in the northern Rockies, firefighters weigh three factors that drive the course of any blaze: topography, weather, and the type of fuel in the line of fire.

**1** Fires can spread especially rapidly up slopes and suddenly explode up canyons, which act as natural chimneys. Southern slopes, sunnier and drier, are more likely to burn than northern exposures.

**2** Dramatic winds brought on by cold fronts and storms can shift a fire's direction or cause flare-ups. Low humidity and high temperatures make fuel, especially grass and accumulated underbrush, drier and quicker to burn.

**3** Air tankers and helicopters, called in by coordinators on the ground, drop water or chemical fire retardant.

**4** A fire crew's priority is to find a man-made or natural barrier to the fire's advance—a road or a stream—and from that anchor point dig a perimeter fire line to contain the blaze.

**5** Long days are spent digging a fire line down to bare earth, even if a bulldozer is available to help. The line is banked to catch rolling debris.

**6** Drip torches are used to burn out fuel between the fire line and the fire, halting its advance.

**7** Felling dead trees prevents them from collapsing across the fire line or on firefighters and helps keep flames from climbing into the canopy.

**8** Homes that have edged into forest fire territory can't be guaranteed protection. And even if fire is stopped before reaching a house, airborne embers can drift through vents and burn it down from the inside out.

TOM ZELLER, JR., NG STAFF  
ART BY BRUCE MORSER  
SOURCES: NATIONAL WILDFIRE COORDINATING  
GROUP UNITED STATES FOREST SERVICE,  
COLORADO FIRECAMP







3

2

6

5

7

## FIRE IN THE WEST

### WHAT BURNS HOTTEST...

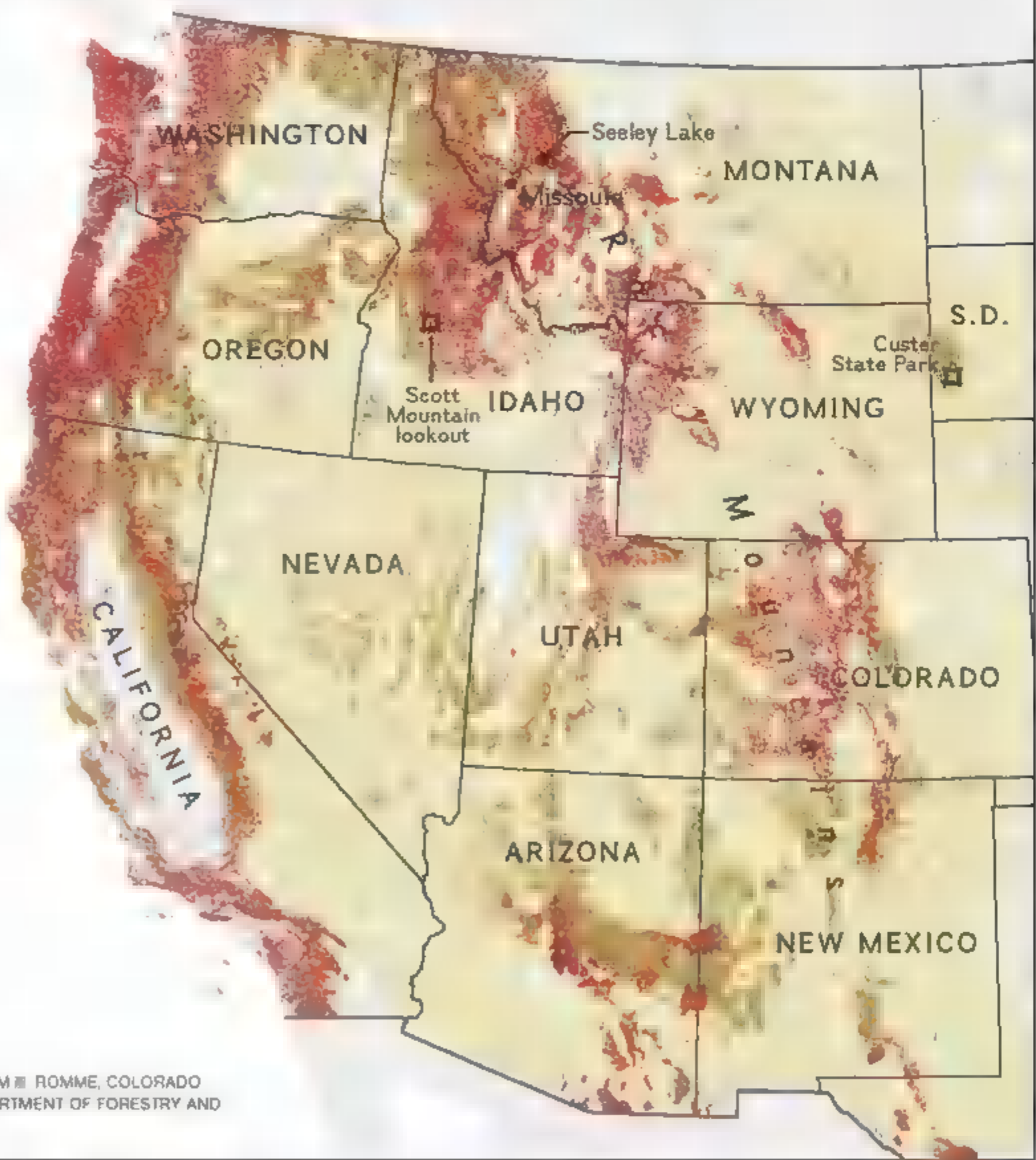
Much of the West is naturally prone to high-intensity fires. The resinous chaparral of southern California and trees like Douglas fir, spruce, and lodgepole pine all fuel severe fires that are hard to contain. Gold areas indicate forests that historically burned at lower intensity, such as ponderosa pine, but can now burn more intensely where fire exclusion has allowed excess fuel to build up.

-  High intensity
-  Potentially high
-  Low intensity
-  No data

0 mi 150  
0 km 150

M. BRODY DITTEMORE NG STAFF

SOURCES: DAVID M. THEOBALD AND WILLIAM H. ROMME, COLORADO STATE UNIVERSITY (TOP); CALIFORNIA DEPARTMENT OF FORESTRY AND FIRE PROTECTION (BOTTOM)



### ...AND MOST OFTEN

In calculating fire risk, analysts also consider how an area's vegetation and climate influence the frequency of wildfires. Within California's high-frequency zone (orange), one or more acres out of every hundred acres are likely to burn each year.

0 mi 100  
0 km 100



In Missoula, Montana, Mark Finney tracks them from his office at the Missoula Fire Sciences Laboratory. Finney is slim and wiry. He has worked on engine crews and might have become a professional firefighter like Barrett, but in college someone noticed he was good at math. Now he spends a lot of time with virtual fire. The federal government has recently begun using a computer-modeling program he helped develop to try to understand how small fires grow into monsters and how we might fight them.

“You can’t know fire unless you play with it,” he says.

The three most important ingredients driving fire are weather, terrain, and fuel. Finney’s program, called Fire Spread Probability (or FSPro), is the latest attempt to make sense of these interacting forces. It can simulate thousands of weather scenarios, based on years of records. It accounts for local topography (fire often moves faster uphill, for example) and the type of fuel: thick stands of trees, grass or chaparral, slash left by loggers. FSPro mathematically synthesizes all of these data on massive computers in Kansas and assigns burn probabilities to individual bits of land. Then it builds a map showing how a fire could advance across a landscape.

The amount of data is immense. Modeling can take hours. Eventually the map emerges from Finney’s printer covered with multicolored inks. A stand of drought-stricken pine near the fire might have an 80 to 100 percent chance of igniting; it appears red on the map. A wet meadow farther away might have a 5 to 20 percent chance: blue. Fires tend to grow in elliptical shapes, so the maps are blotched with rainbow rings, like tie-dyed T-shirts. FSPro can be used with other powerful programs, such as Google Earth, to create intricate maps showing the location of houses, roads, dams, even wildlife habitat—crucial information for firefighters. As a fire moves, the maps are updated and fed to commanders, helping them decide which

areas are most likely to burn, where best to deploy their armies.

Up and down the fire lines, people know of Finney and his program. It is something new, something promising. But it can only give probabilities. “People really want to know the ultimate extent and shape of a fire,” Finney says. “And that’s just not possible.”

In early August, FSPro takes on the kind of blaze it was built for: an inferno surging across a checkerboard of public and private lands, some quilled with trees, some heavily logged, some inhabited. The Jocko Lakes fire begins with a lightning strike in the brown hills of western Montana. It smolders in secret for a few days, consuming dead wood and desiccated brush. Then the wind arrives. The fire roars. By the time someone notices it on a blustery Friday, it is uncontrollable. FSPro guesses where it could go and shows the inhabited areas in the way.

But Jocko moves too quickly for the young program. Observers watch the fire burst from 10 acres to 300 in 20 minutes. By Saturday evening it runs toward the town of Seeley Lake, prompting the evacuation of an estimated 675 homes. For a time, Jocko becomes the most important patch of burning earth in America, a magnet for

## **VAST TRACTS OF DROUGHT-WEAKENED FOREST HAVE SUCCEDED TO INSECTS AND DISEASE, TURNING TREES TO TINDER.**

firefighting resources. At six days old it encompasses an area larger than Manhattan.

Outside Seeley Lake, Patricia Rerick and Ralf Schurmann have an hour to pack. They can see the flames from the deck. They fumble through the calculations of disaster.

*It won’t really happen. We’ll be back in a few days. What should we take?*

They collar their three dogs, grab dog food and a few official documents, and pile into their pickup. The house was new.

In a few days they return to a crater filled with

twisted metal and rimmed with blackened nails. Their bedsprings, the cloth burned away. Shattered plates. The refrigerator shriveled and bowing toward the earth. They sift through the wreckage. It tinkles under their feet, the sound of thin ice cracking. Ralf masters the art of identifying disfigured relics.

"What's this, honey?" Patricia holds up some crisped object.

"DVD player," he says.

**"WE HAVE THE ABILITY TO BE  
COMPATIBLE WITH FIRES, BUT WE MOSTLY  
CHOOSE NOT TO BE."** JACK COHEN, FIRE SCIENTIST

A ceramic rooster emerges from the pile, sooty but intact, a gift from Ralf's mother. Patricia winces.

*Of all the things.*

Bits of ash spin down, soft as eyelashes. Some of the landscape surrounding the couple's home is charred and dead, corpses of trees, smoke hanging gray between them. Some is green and living, intact meadows, stands of untouched pine. On an FSPRO map, the entire neighborhood was red, highly fire prone. But the neighbors' houses survived.

*Why us?*

"The firefighters kept reassuring us. They said they'd drop retardant all around it."

The firefighters were probably young. Older ones tend not to make promises.

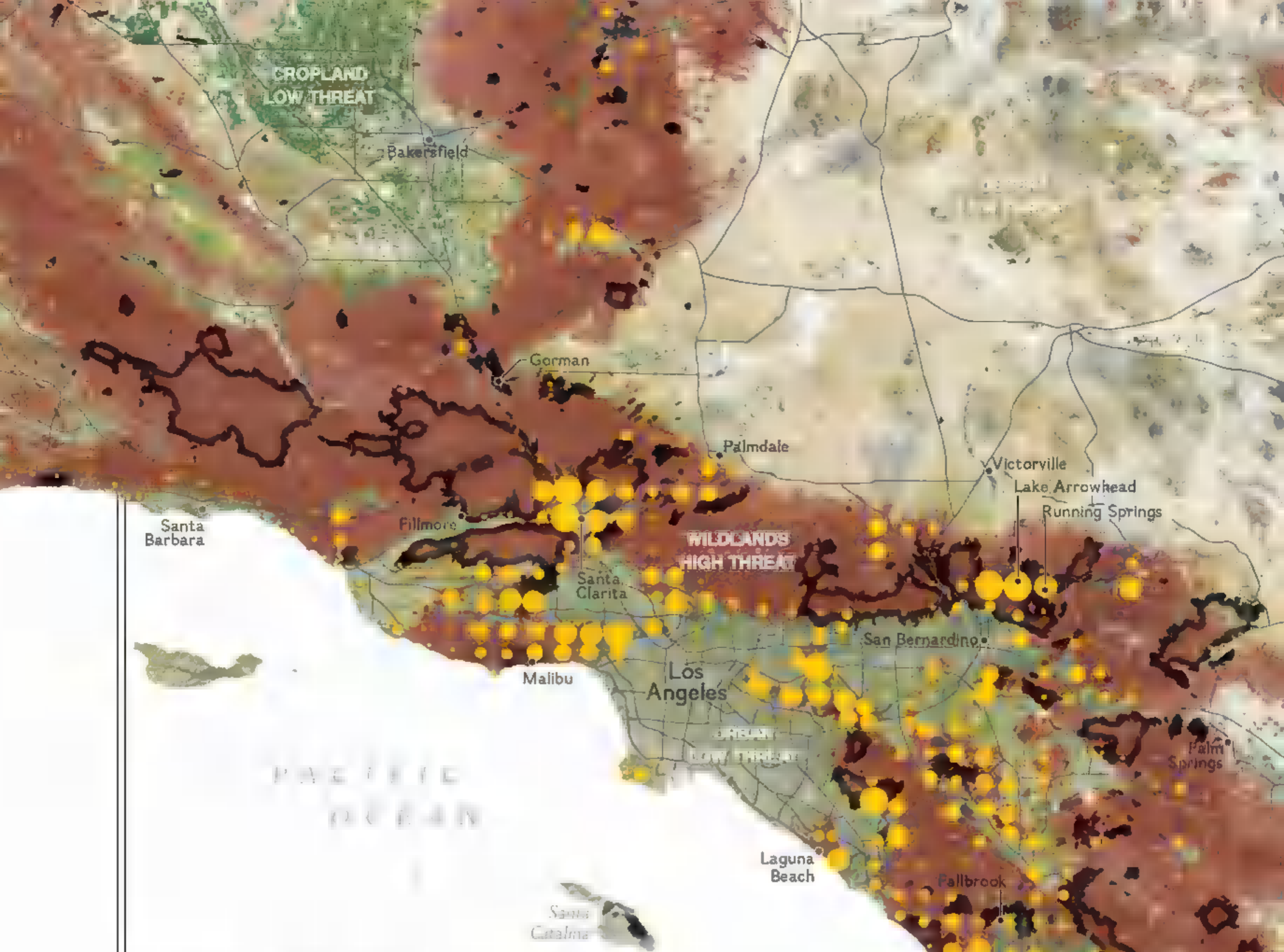
**T**he Jocko Lakes fire burned some 36,000 acres and cost over \$30 million. At the time, it seemed large. Then came California. For three weeks last fall, fires swept the southern part of the state. Firefighters arrived in force. They fought and retreated and retreated again. There was little they could do but make sweat-drenched stands outside homes, and hope for the wind to die. More than half a million people were evacuated and over 2,000 homes were destroyed. Images of disaster saturated

newspapers and television. Plumes of smoke, visible from space, arced over the Pacific. If the nation was shocked, most experts weren't. "If anyone was surprised, it was because they were young or inexperienced," says Jack Cohen, a federal fire researcher who lived in southern California for a decade and often returns to study the wildland-urban interface. Cohen names other deadly, destructive California fires. Oakland-Berkeley Hills, 1991. Laguna Hills, 1993. Cedar and Old-Grand Prix, 2003—a year even worse than 2007.

The state's fire environment differs in significant ways from the rest of the West. Southern California fires often begin and grow in chaparrals, dry thickets of shrubs and trees, many of them oozing combustible resins, all of them well adapted to fire and ready to burn. Usually the fires are ignited directly or indirectly by humans. A boy playing with matches caused one of 2007's major blazes; arsonists lit others. The fires become fierce because Santa Ana winds—strong seasonal winds unique to California—act as giant bellows. When the Santa Anas blow, California often burns.

The region is also the extreme expression of the trend to place ourselves in fire's way. California is the most populous state, growing by roughly ten million people every 20 years. Much of the south is particularly crowded. Houses clot the furrowed landscape. Factors that once constrained settlement—sparse water and remoteness, for example—no longer apply. Americans have been increasingly freed, even encouraged, to spread out and pick plots based less on logic and more on the view. The government policy on this migration into fire territory has been no policy at all, and Americans generally want it that way.

Cohen has watched this movement for more than two decades. He has a deep sense of irony and laughs at his own crankiness, accumulated over years spent watching people ignore the power of fire and repeat their mistakes. After



## LIVING WITH FIRE

Southern California epitomizes the trend of the West: People have moved into scenic yet fire-prone wildlands, accelerating the cost of firefighting to protect lives and property. With fast-burning fuels and a history of frequent fires, southern California's wildland-urban interface, as these growing areas are called, is now home to more than six million people, with over 800,000 living in the highest fire-threat zone (brown). Wildfires in 2007 forced a record evacuation of more than half a million people.

- Area of highest fire threat
- Areas burned 2000-2007

Population of the wildland-urban interface within the highest fire-threat zone

- More than 10,000
- 5,000 to 10,000
- 1,000 to 5,000
- 500 to 1,000
- Fewer than 500



■ BRODY DITTEMORE, NG STAFF  
 SOURCES: CALIFORNIA DEPARTMENT OF FORESTRY AND FIRE PROTECTION; U.S. CENSUS BUREAU

the autumn fires he again traveled to California and again found himself shaking his head.

"The scale of the evacuation was bizarre, quite frankly," he says. "When you evacuate 300,000 houses, to me that's a suggestion that you don't really know what you're doing. With all of our technology, we are obviously incompatible with the environment that we live in."

Cohen is an expert on how houses catch fire. If you examine a neighborhood after a large fire, he says, one of the most striking details is the green, unburned vegetation that often remains between the ashen heaps. It's a sign that what probably ignited the houses was not burning trees or chaparral; instead, the houses touched off one another as embers blew like wind-borne viruses. They landed on the roof or blew under the eaves. They sifted through ceiling vents. In dense neighborhoods, houses replace trees as the primary fuel.

Houses need not serve as tinder, Cohen says; they can be built with fire-resistant roof shingles and siding. "In California there were significant cases of communities that did not burn and did not evacuate because they were fire resistant." Some California communities require fire-resistant construction. Many others do not. "We have the ability to be compatible with fires," Cohen says. "But we mostly choose not to be."

No single action will reduce fires or their damage. Saw-wielding crews may thin the fuel load, but there is simply too much overgrown land. Prescribed burning, fires set on purpose, is a common, if risky, method. It remains to be seen if Americans will voluntarily stop moving into fire-prone areas, or if they will take to the idea of letting natural fires burn unchecked. The best approach would consider all these measures and apply each where appropriate. That would also require a rare symphony of government effort and public will.

And yet, regardless of policy, a basic problem remains: Fire is a force beyond control. Americans in particular have been reluctant to acknowledge that no government or technical solution, no matter how well funded, or brilliant, can

halt natural processes or remove their power to affect lives. For this reason, and with an eye toward the increasing costs, many experts believe it is time for a new era of American responsibility, perhaps with policies like those in Australia, another country facing massive wildfires. There the government does not attempt to protect all private property. Responsibility is placed largely on individuals. Citizens are encouraged to evacuate well *before* wildfires arrive—when weather forecasts indicate danger—and government programs teach methods for making homes less vulnerable.

Mark Finney, the fire forecaster, lives in a fire-prone area outside Missoula. He decided long ago he would not depend on others to



protect his home. So each autumn, before wet, cold weather leaks over the mountains, he waits for the humidity to be just right, for the wind to blow just so, and then he burns portions of his 50-acre spread. His two sons carry torches and stare at the flames. His old dog rolls in the ash and cloaks itself in soot. The small fires he creates clear dead, dry brush, surrounding him in the blue ink of low probability. When the big fire comes, it won't find much fuel. Odds are it will chew right past.


"I'll sit back with a beer and watch," he says, grinning. *You can't know fire unless you play with it.*

Finney's neighbors occasionally ask if they can borrow his fire-setting tools. He says no.

His approach is not for everyone; it requires an intimate knowledge of fire and the landscape. But we can all pay closer attention to the choices we make, the environments we live in. In California, many of the homes destroyed last fall are already being rebuilt. With every new house raised in the chaparral or slotted into the evergreen forests of the Rockies, a wager is placed. *It won't happen to us.* In fire's terms, it is the equivalent of rebuilding below sea level in New Orleans. The water, the flames, will return. They always do.

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🔪 **Firefighters** do battle with wildfires in staff photographer Mark Thiessen's behind-the-scenes pictures and video at [ngm.com](http://ngm.com).



**OBLITERATING HOUSES** and forcing hundreds of thousands to flee, 18 large wildfires ripped across southern California's parched, crowded hills in three weeks last year. In this neighborhood near Lake Arrowhead, 178 homes burned—most in just two hours.



**A MAELSTROM** Embers whips across a field near Santa Clarita, California. Driven by Santa Anas—fierce winds that can gust at more than a hundred miles an hour—wildfires burned hundreds of square miles of drought-stricken trees and brush in 2007, with exhausted fire crews struggling to keep up.







**BEFORE AND AFTER:** Just one ember, landing in dry pine needles heaped at the foot of a staircase, was all it took to incinerate this house during an October 2007 fire in Running Springs, California. Beyond the debris, living trees reveal that fires often jump from house to house, sparing vegetation.





**MANY TRIED TO HELP**—federal and local firefighters, even bystanders like this man near Santa Clarita—as some 2,200 California homes went up in flames. Americans increasingly choose to live in high-risk areas. “Fire is not a problem,” says ecologist Dave Peterson. “People living near fire—that’s the problem.” [1](#)





Spectacle of color and shape, hard coral carpets a shallow seafloor on Kingman Reef. Scientists visiting the remote Pacific Ocean atoll reef describe it as a “time machine,” an ecosystem that has survived in an almost pure state of nature.



A RARE, PRISTINE REEF  
TURNS OUT TO BE A LANDSCAPE  
OF FEAR, WHERE PREDATORY  
FISHES REIGN AND THEIR  
PREY IS IN HIDING.

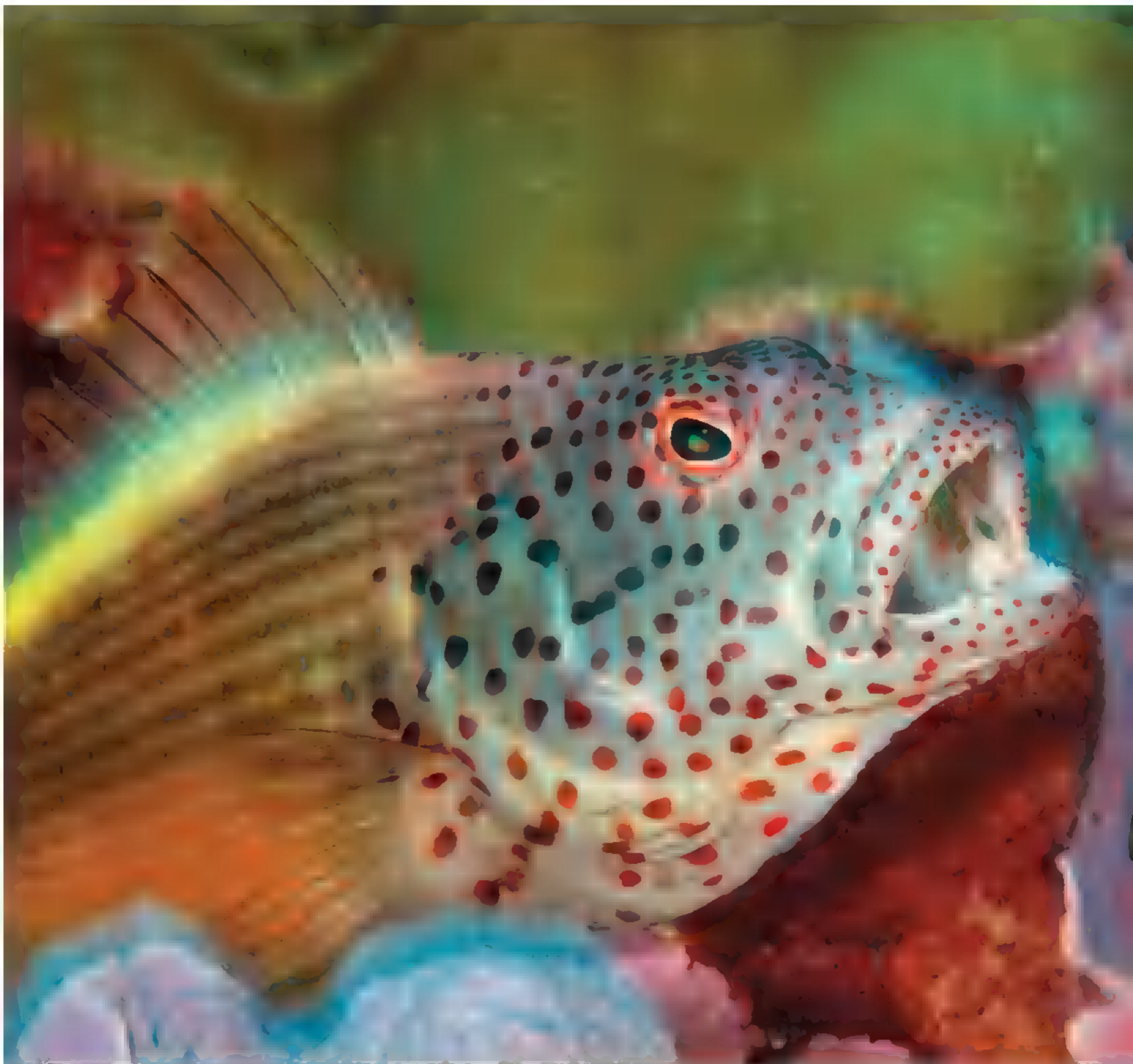
# an uneasy eden

Sharks—whitetip and gray reef—and red snappers prowl Kingman's waters for food. Cloud-like schools of fish, a common sight at most reefs, hardly exist here. The healthy abundance of large predators, accounting for 85 percent of the fish biomass, forces most prey fish into hiding.









BY KENNEDY WARNE  
PHOTOGRAPHS BY BRIAN SKERRY

**T**ropic breezes rustle the palms, a turquoise sea laps white sand, and below the surface a coral reef teems with photogenic fish. What could possibly be wrong with this postcard scene? Enric Sala, a marine ecologist, says such a seemingly flourishing reef might actually be an ecosystem in distress.

This radical notion fits with what Sala, a National Geographic Fellow, has observed during two recent expeditions to Kingman Reef, part of a chain of Pacific atolls and islands (called the Line Islands) that straddles the Equator 1,000 miles south of Hawaii. Places like Kingman, remote and near pristine, preserve



Ambush specialist, a blackside hawkfish lurks amid coral to surprise smaller fish and crustaceans. A mid-level player in the food web, the hawkfish must strike swiftly and retreat to its hiding place, or else a red snapper, larger and equally vigilant, may grab it.

water, nothing grows. The only dry land consists of a few spits of sun-whitened coral rubble and the dead shells of giant clams. But beneath the surface is a world of rare luxuriance. The reef is a glittering city of staghorn, mushroom, pillar, and plate corals packed so tightly together there is hardly a patch of bare sand. Through their interstices dart fusiliers and damselfish, butterflyfish and parrotfish, and scores more of the plankton sippers, coral nibblers, and algae grazers that populate a reef-fish community.

Patrolling above the coral skyline are the reef's overlords: gray and whitetip reef sharks and hordes of aggressive red snappers. Indeed, fully 85 percent of Kingman's fish biomass is in the form of these large predators, and three-quarters of the predator biomass is sharks—the opposite of the conventional reef snapshot, with rainbow throngs of aquarium-size fishes frolicking in a coral garden and barely a predator in sight. Kingman's proportion of apex predators, the top tier of the traditional biomass pyramid, is greater than has been found in any other coral reef ecosystem. Here the biomass pyramid is turned on its head.

At first glance, an upside-down pyramid is counterintuitive. On land, we are familiar with the notion that an apex predator, such as a lion, must eat many wildebeests to survive. But imagine a world with one pound of wildebeest for every five pounds of lion. The only way an inverted pyramid can function is if there is rapid turnover of biomass at the lower levels. Prey must be fast growing and quick to replenish; predators must grow slowly and live long. This seems to be the case at Kingman Reef. In the warm tropical waters, many prey species spawn several times a year, replenishing their stocks as rapidly as the predators deplete them. Even so,

a record of the world when the human footprint was light. They provide a reference point against which to measure change and a blueprint for conservation. But they are a scarce resource. "Worldwide, there are maybe 50 reefs in this sort of condition," says Sala. He chose the Line Islands because they provide a gradient of human impact—from uninhabited, unmodified Kingman Reef at one end to ecologically degraded Kiritimati (Christmas Island), with a population of more than 5,000, at the other.

Kingman's 30-mile triangle of coral encloses a lagoon the size of Manhattan Island. Above

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*Kennedy Warne was the founding editor of New Zealand Geographic. Brian Skerry specializes in photographing underwater stories.*



It's divers who found it, that from a distance it looked like a flying saucer. In closer examination, ecologist Eric Sala sees a *Sipuncula lobe* fossil that may be 500 years old. According to expert Dr. Maragos, the species is likely to be new to science.





A thicket of tentacles belonging to *Heteractis magnifica*, the magnificent sea anemone, provides cover for ■ transparent shrimp the size of ■ rice grain. The sea anemone, anchored to the reef, ignores shrimp but nabs small fish and other passersby.

the prey barely manage to sustain the predators: Researchers found the stomachs of red snappers at nearby Palmyra Atoll, another protected reef, mostly empty. The picture that emerges of life on a healthy reef is one of abundant predators living in perpetual hunger and scarce prey living in perpetual fear.

If predator-dominated Kingman represents the gold standard for coral reefs, how does the

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■ **Society Grant** This research project was funded in part by your Society membership.

removal of large carnivores through fishing affect coral communities elsewhere, such as in Kiritimati? As the report from the Line Islands shows, overfishing can unleash a population boom of smaller fish. The reef might appear luxuriant for a time, but in a matter of decades its ecosystem can unravel from a wonderland of marine diversity into a sediment-choked ecological desert.

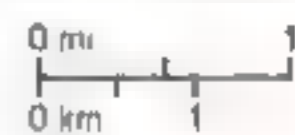
“Eliminating the top predators speeds the turnover rate of the entire reef community,” Sala says. Through mechanisms not yet fully understood, this acceleration ultimately produces an explosion of microbes, some of which may cause coral death. Fishing out the large herbivores contributes to reef degradation. In the absence of grazers, large algae flourish, and their photosynthetic activity increases the availability of

Uninhabited and mostly submerged, U.S. owned Kingman Reef became a national wildlife refuge in 2001. Its protected, predator-rich ecosystem provides a contrast to Kiritimati atoll, where prey outweigh top predators due to fishing pressure (chart).

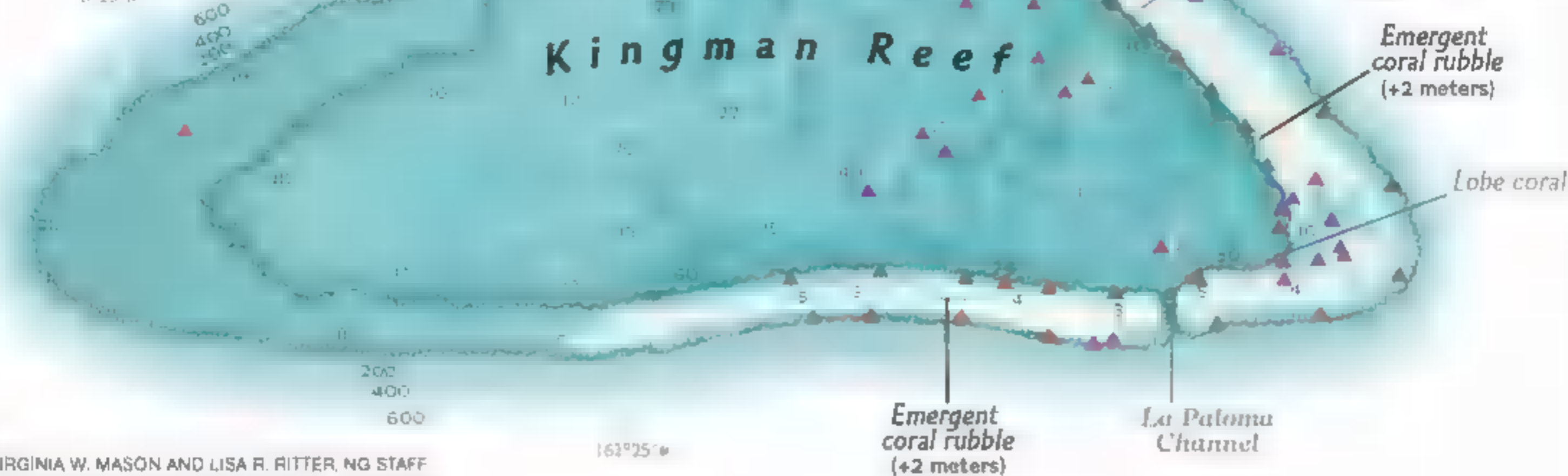
	KINGMAN REEF	KIRITIMATI
Top predators	85%	15%
Carnivores	9%	54%
Herbivores	6%	31%
<b>TOTAL BIOMASS</b> (metric tons per hectare)	<b>5.3</b>	<b>1.3</b>

▲ Research site

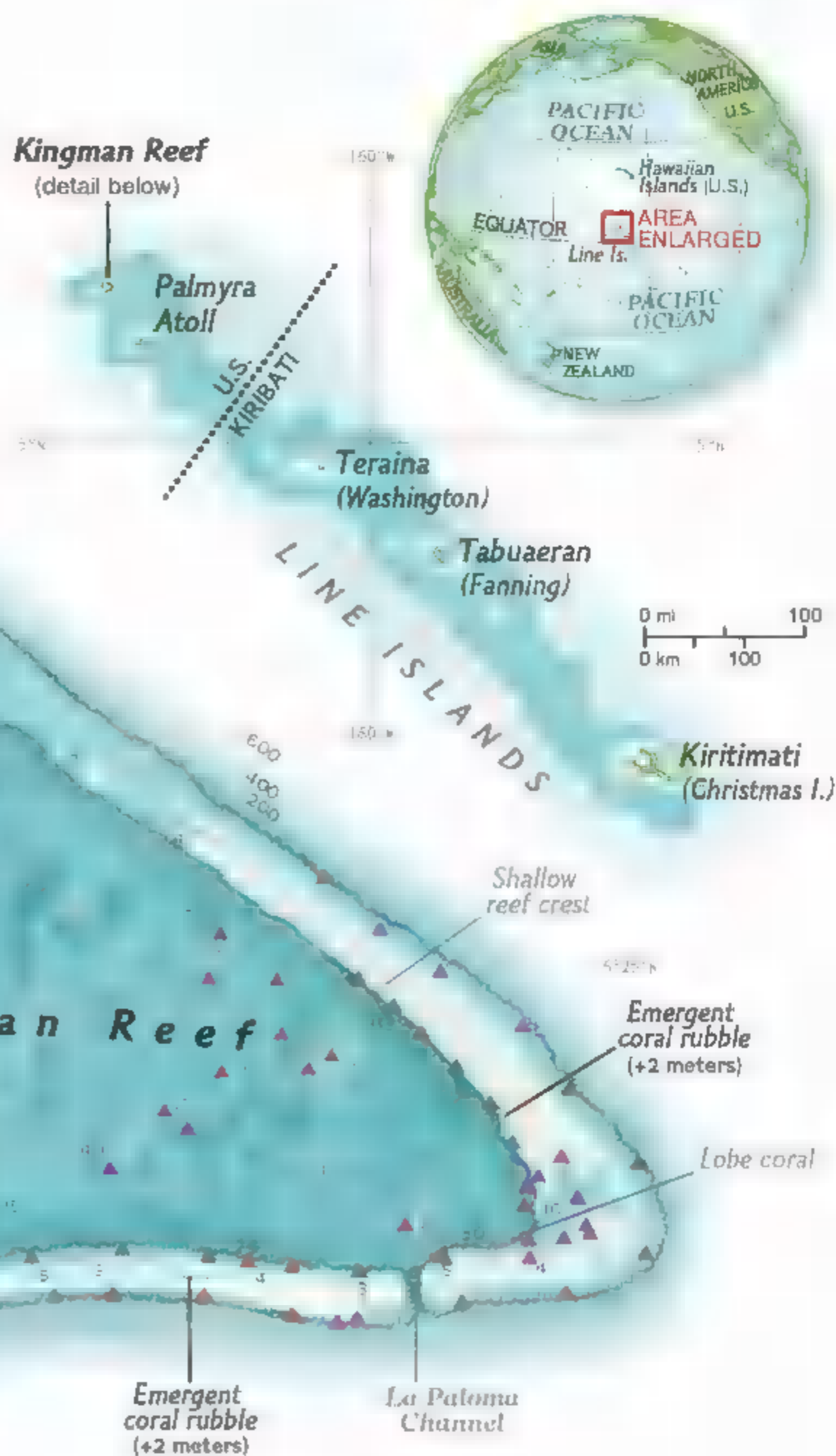
Depth ■ meters



62°25'W



VIRGINIA W. MASON AND LISA R. RITTER, NG STAFF  
SOURCES: GEOEYE (REFERENCE SATELLITE IMAGE);  
NOAA; U.S. FISH AND WILDLIFE SERVICE



dissolved organic carbon in the system, boosting the growth of bacteria.

“It’s bad for corals to be bathed in microbes,” says Elizabeth Dinsdale, an expedition microbiologist. Ten times as many microbes populate the water above Kiritimati as live above Kingman. It’s the difference, Dinsdale says, between swimming in a sewer and a chlorinated pool.

This research comes at a critical time for coral reefs, in trouble across the globe as rising greenhouse gas levels warm the oceans and boost the acidity of seawater. Elevated temperatures trigger mass episodes of coral bleaching. Rising acidity, the result of increased carbon dioxide absorption, threatens the very coral matrix. Pollution and overfishing make matters worse.

“Working out the relationships between overfishing and reef health is critical,” says Sean

Connolly, an Australian reef expert. “Protecting reefs from overfishing is within our power and might help mitigate adverse effects of other changes, such as global warming.”

To Sala the message is clear: Overfishing is ecological sabotage. “It’s like removing vital parts from a machine and expecting it to keep functioning,” he says. At Kingman, the machine still has all its parts. And because the ecosystem is largely intact, it has stability and resilience and is able to recover from environmental stresses. Kingman Reef provides one of our last, best glimpses of what a coral reef should be: a postcard from the past for the benefit of the future.

➤ **Rethinking Reefs** Photographer Brian Skerry and marine ecologist Eric Sala tell how Kingman reef has changed scientific thought in a video at [ngm.com](http://ngm.com).



Wary of being eaten, a fang blenny (top) and a combtooth blenny (bottom), both just a few inches long, feel safe in their coral hideouts. Fang blennies do take risks, venturing out to feed on scales, fins, and even mucus coating the skin of larger fish.





Needle-sharp teeth matched with voracious hunger make the red snapper the reef's most aggressive predator. Reaching lengths of 30 inches, snappers sometimes attacked the divers, biting at ears and hair. "They wanted to taste us," says Sala.



This is how a healthy reef looks: corals lush and various covering the seabed; water as clear as air; and a large native predator—a red snapper—hunting for elusive prey. Kingman Reef's secret? Not a human predator in sight. 📷



# HOW TO HELP

**UNDER FIRE, PAGE 116** **Don't Fan the Flames** Each year more Americans move into what is called the wildland-urban interface: zones where human habitation meets forests or grasslands. Many wildfires start in such places; under the right conditions, flames or embers can easily spread to nearby homes. Fortunately, there are ways (below) to make a house in those zones less vulnerable to fire, from the choice of building materials to the landscaping decisions. More information is available at [firewise.org](http://firewise.org).

## 1 Improve the Roof

Fire-resistant ceramic tiles, slate or composition shingles, and metal sheets provide better protection than wood.

## 2 Seal Off Openings

Put metal screens over vents and other openings to block embers.

## 3 Prune Branches

Flames can jump from branches hanging over the roof of the house.

## 4 Mow the Lawn

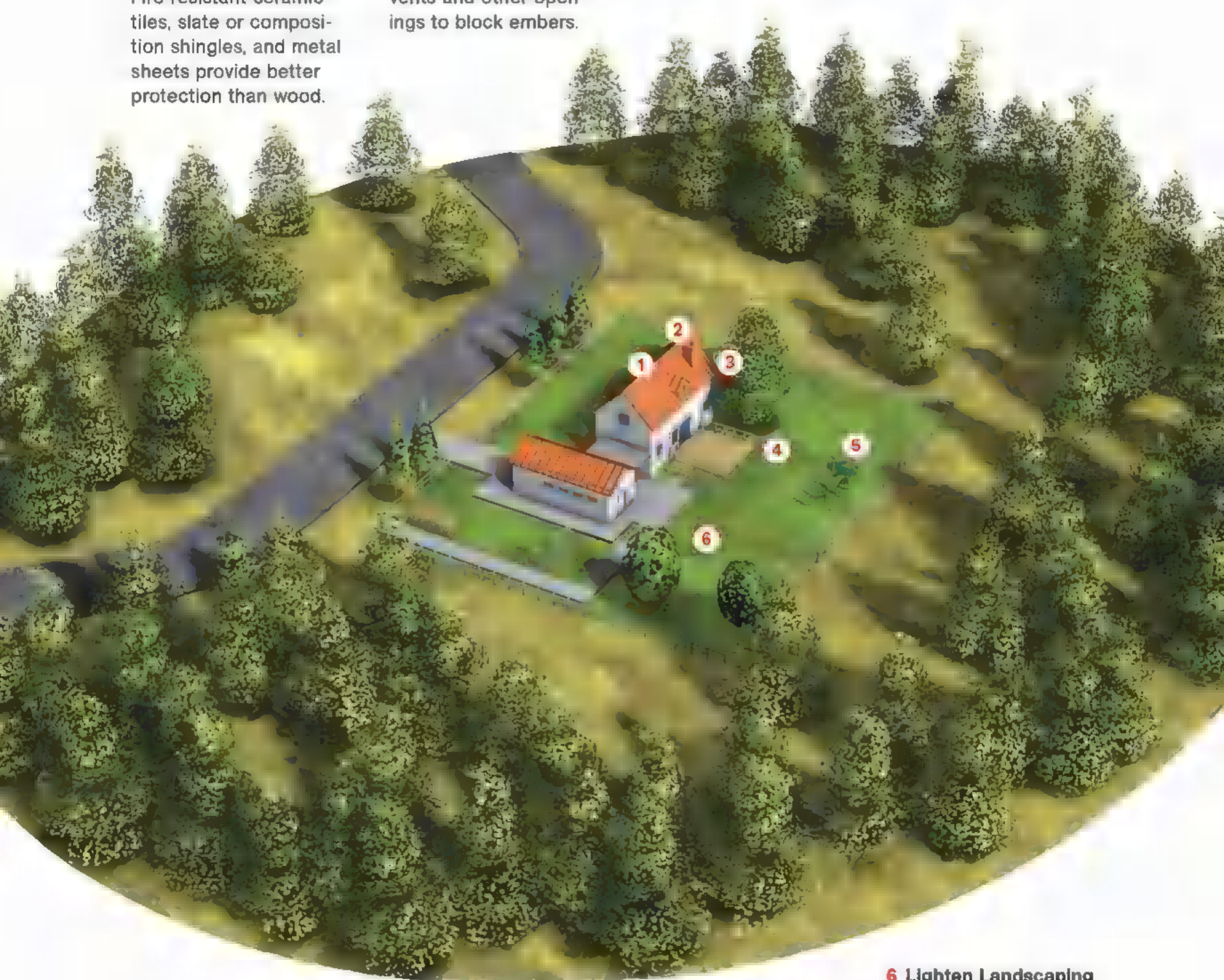
Keep grass short and well watered to hinder the spread of flames.

## 5 Pick Up Debris

Remove leaf litter and pine needles from gutters, dead limbs from around the house.

## 6 Lighten Landscaping

Spacing out trees and shrubs makes it harder for flames to travel and easier for firefighters to work.



## If You Owned or Leased any of the GM vehicles below, You can receive cash back for certain repairs.

In a class action settlement, GM will reimburse class members from \$50 to \$800 for certain repairs. Repairs within the earlier of seven years or 150,000 miles after the date of original vehicle ownership or leasing are covered.

### What is this about?

Lawsuits claim that Dex-Cool in the vehicles listed below caused problems with the vehicles' engines or cooling systems and that certain engine components were defective. GM denies that Dex-Cool caused problems and that any engine components in the vehicles were defective.

### What repairs are covered?

Repairs vary by vehicle. To determine whether you may receive cash back for a repair, contact the Settlement Administrator or the website listed below. Generally, the covered repairs include lower intake manifold gaskets for 3.1L and 3.4L vehicles; engine sealability repairs for 3.8L vehicles (L36); and repairs related to engine sludge for 4.3L vehicles.

### Who and what vehicles are covered?

You may be able to file a claim if you ever owned or leased, for personal use, one of the vehicle models listed below and paid for a covered repair. Check the website to see if your vehicle model may also be included in the settlement.

#### **CERTAIN 3.1- AND 3.4-LITER ENGINE GROUP: MODEL YEARS 1995 - 2003**

Buick	<i>Century, Rendezvous, Regal, Skylark</i>
Chevrolet	<i>Impala, Lumina, Malibu, Monte Carlo, Venture, Corsica, Beretta, Lumina APV</i>
Oldsmobile	<i>Alero, Cutlass (Supreme and Ciera), Silhouette</i>
Pontiac	<i>Aztek, Grand Am, Grand Prix, Montana, Trans Sport</i>

#### **CERTAIN 3.8-LITER (L36) ENGINE GROUP: MODEL YEARS 1995 - 2004**

Buick	<i>LeSabre, Park Avenue, Regal, Riviera</i>
Chevrolet	<i>Camaro, Impala, Lumina, Monte Carlo</i>
Oldsmobile	<i>Eighty-Eight, Intrigue, LSS, Ninety-Eight</i>
Pontiac	<i>Bonneville, Firebird, Grand Prix</i>

#### **CERTAIN 4.3-LITER ENGINE GROUP: MODEL YEARS 1995 - 2000**

Chevrolet	<i>Blazer, Chevrolet S-10</i>
GMC	<i>Envoy, Jimmy, S-15</i>
Oldsmobile	<i>Bravada</i>

### What should I do?

Get the complete information below and decide on your legal right to:

- Remain in the settlement and file a claim, object to or comment on the settlement. If you stay in the settlement you will be bound by the Court's rulings. You must file your claim by **October 27, 2008**.
- Exclude yourself and keep your right to sue GM on your own. You must exclude yourself or object/comment in writing by **August 13, 2008**.

The Court has appointed Counsel to represent everyone. If the settlement is approved, GM will pay them separately. You can also hire your own attorney at your own cost.

The Court will determine whether to approve the settlement at a Fairness Hearing on August 29, 2008 at 11 a.m.

If you purchased your vehicle in Missouri, a different hearing date applies to you. See below.

**For complete information and a Claim Form or for updates to this Notice:**

**Call: 1-866-245-4291 Visit: [www.dexcoolsettlement.com](http://www.dexcoolsettlement.com)**

**Or Write: Dex Cool Litigation Settlement Administrator  
P.O. Box 9239, Dublin, OH 43017-4639**

Mark Thiessen covers firefighters in Montana.



**ON ASSIGNMENT Shooting the Blaze** Staff photographer Mark Thiessen has shot forest fires for years as a personal project. He's a trained firefighter himself and knows where he can safely set up his tripod—and what to watch out for. "It's hard to keep your eye on the viewfinder," he says. "You want to have your head on a swivel with all the dangers around you."

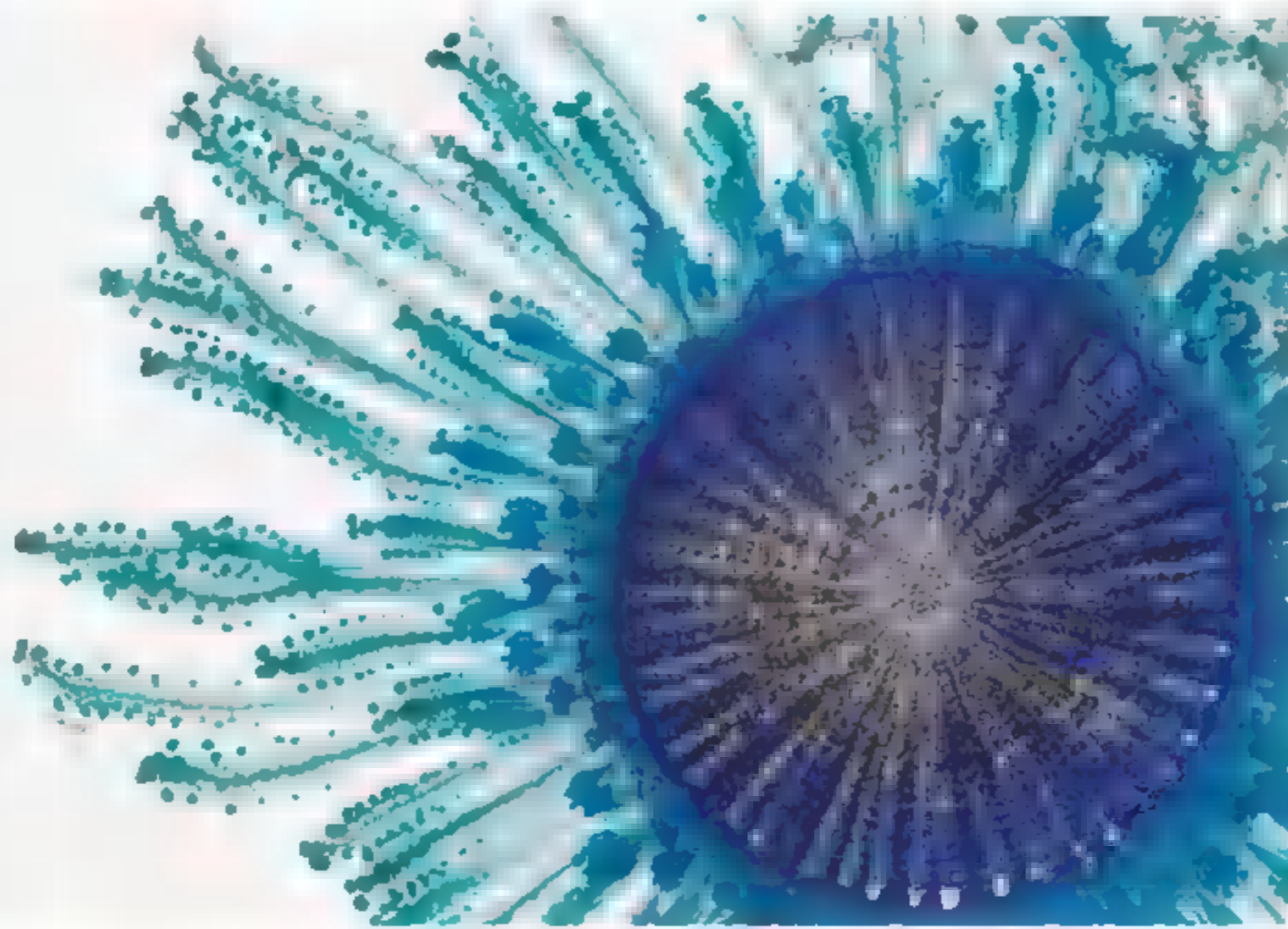


Contributing writer Mark Jenkins (left) interviews rebel general Laurent Nkunda, called the "Chairman," in the Democratic Republic of the Congo.

**ON ASSIGNMENT Buddy System**

When he was writing "Who Murdered the Virunga Gorillas?" Mark Jenkins needed someone he could count on. "I felt lucky being paired with [photographer] Brent Stirton," he says. "A partner with the same mind-set is invaluable. We were surrounded by people with weapons all the time. It's important to be calm in those situations. If you overreact, things can quickly go sour." Also essential: a sense of humor. "You need it so that you're not emotionally ruined by what you're immersed in."

## INSIDE GEOGRAPHIC

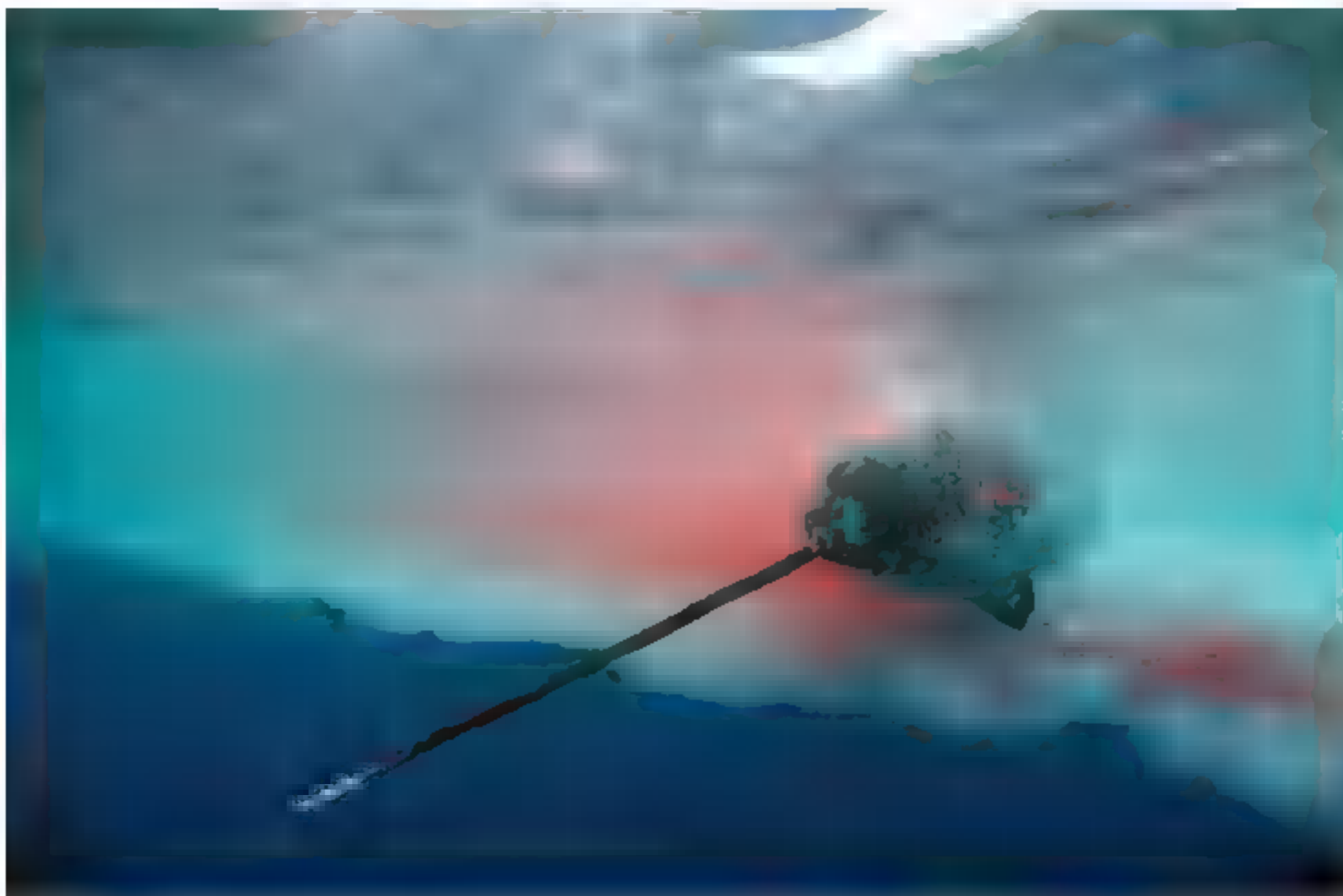


### World of Photos

Every year, the organization World Press Photo holds a contest to find the best photojournalism in the world. This year three photographers were honored for their work in *National Geographic* stories covering the microscopic to the biblical.

#### David Liittschwager

won First Prize Nature Story for "Marine Miniatures" in the November 2007 issue.



#### Paul Nicklen

won Second Prize Nature Story for "Narwhals" in the August 2007 issue and Third Prize Nature Story for "Vanishing Sea Ice" in the June 2007 issue.



#### Christopher Anderson

won Third Prize Daily Life Story for "Bethlehem" in the December 2007 issue.

# INSIDE GEOGRAPHIC

An orphaned gorilla curls up with a ranger who is her caregiver.



**Gorilla Killings** In July 2007, the execution-style killings of mountain gorillas in the Democratic Republic of the Congo shocked the world. What's happened since? *Explorer* follows rangers in Virunga National Park as they try to keep gorillas safe in a war zone—and photographer Brent Stirton as he documents the rangers' dangerous work. Watch *Explorer: Gorilla Murders* on the National Geographic Channel, Tuesday, July 1, at 10 p.m.

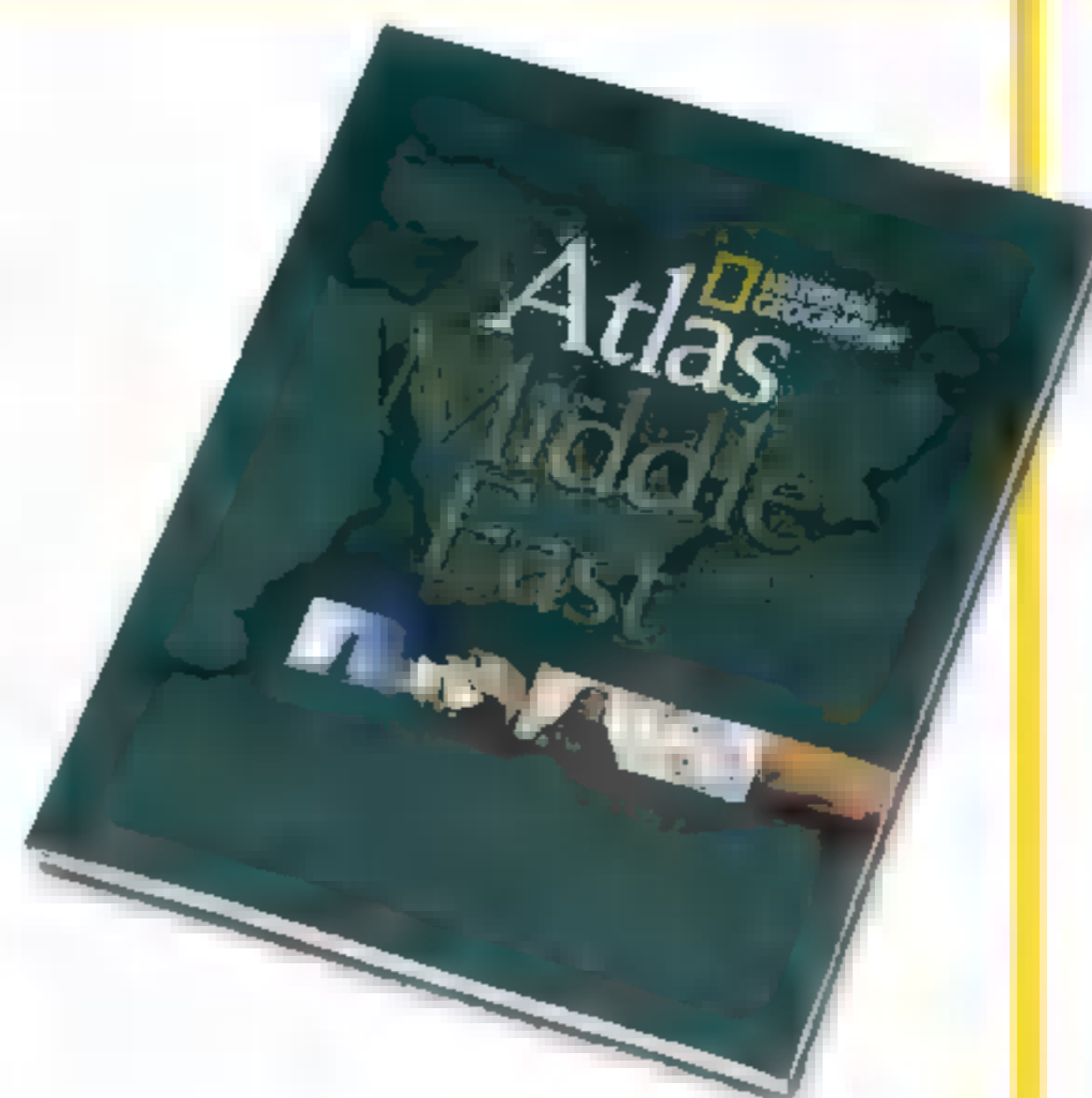
## NG Books

### Mapping the Middle East

Mosul, Gaza, Kabul—these cities appear in headlines every day. *Atlas of the Middle East* puts the news in context, with maps, photos, and graphics on topics that include history, conflict, climate, and water supplies. With new information on Sudan, Afghanistan, and Pakistan, this second edition of the atlas gives geographical and political context for events occurring from Darfur to Kashmir.

Oil has been central to the Middle East since its discovery

there a hundred years ago. The atlas tracks oil from its sources to its biggest users—Saudi Arabia is the region's top producer, averaging over nine million barrels ■ day, and the U.S. consumes the most. Also offered are data on countries' widely varying literacy rates (28.1 percent in Afghanistan to 97.6 percent in Cyprus) and ethnic breakdowns. Regional maps show in depth the distribution of language, land use, and religion in the nations that make up this region (\$21.95).







*Learning a little Spanish from a macaw named Sanchez on Macaw Mountain isn't the only reason you'll visit Honduras. But it's one of the many reasons you'll never forget it.*

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**Proper Shoppers** Indigenous Bolivian *cholitas* check out the latest merchandise in a La Paz appliance store. This picture was acquired for—but not published in—the March 1943 *National Geographic* story “Bolivia, Tin Roof of the Andes.” It’s possible these women weren’t just window-shopping. “Urban *cholitas* have little to do with popular beliefs of a timeless, unchanging indigenous culture,” explains American University anthropology professor Lesley Gill. Today, “they are urban born and frequently well-to-do. They make their money primarily from commerce, and their style of dress expresses a dynamic, expensive, and completely modern sense of Aymara femininity. Many hats come from Italy, for example,” Gill notes, “and nowadays the cloth for their skirts comes from Korea.” —Margaret G. Zackowitz

👉 **Flashback Archive** Find all the photos at [ngm.com](http://ngm.com).

PHOTO: FENNO JACOBS, THREE LIONS/NATIONAL GEOGRAPHIC IMAGE COLLECTION

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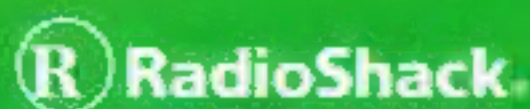
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